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The present volume is the sixty-second of this series.

The Bulletin, publication of which was begun in 1875, is a series of more elaborate papers, issued separately, and, like the Proceedings, based chiefly on the collections of the National Museum.

A quarto form of the Bulletin, known as the "Special Bulletin," has been adopted in a few instances in which a larger page was deemed indispensable.

Since 1902 the volumes of the series known as "Contributions from the National Herbarium," and containing papers relating to the botanical collections of the Museum, have been published as Bulletins.

WILLIAM DEC. RAVENEL,
Administrative Assistant to the Secretary,
in Charge of the United States National Museum.

NOVEMBER 26, 1823.

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9. *Nodulicoccus levis* (Maskell). A, Adult female, outline from above, ×57.5; B, adult female, thoracic spiracle, ×115; C, larva, outline from above, ×57.5; D, larva, dorsal "spines," ×640; E, adult female, derm pore, ×1,500; F, adult female, abdominal spiracle, ×115; G, adult female, beak, ×57.5; H, larva, disk pore, ×1,500; I, adult female, derm spines and setae, ×640; J, larva, antenna, ×165; K, larva, marginal "spines," ×640; L, adult female, leg, ×57.5; M, larva, seta, ×1,500; N, adult female, anal ring area, ×57.5; O, adult female, section of ventral derm anterior to anal ring, ×220; P, adult female, disk pore, ×1,500; Q, adult female, disk pore, ×1,500; R, adult female, section of dorsal derm anterior to anal ring, ×220; S, larva, claw, ×640 21

10. *Auloicerya australis* (Maskell). A, Larva, disk pore from around anal ring, ×1,500; B, larva, dorsal disk pore, ×1,500; C, larva, ventral disk pore, ×1,500; D, larva dorsal and ventral, ×57.5; E, adult female, leg, ×57.5; F, adult female, disk pore, two views, ×1,500; G, larva, claw, ×640; H, larva, seta, ×115; I, adult female, antenna, ×57.5; J, adult female, variations in more abundant disk pores, ×1,500; K, larva, tricuspidate apex of seta, ×1,500; L, larva, abdominal spiracle, ×1,500; M, larva, leg, ×115; N, adult female, ventral disk pore from region of vaginal opening, ×1,500; O, adult female, derm seta, ×500; P, larva, antenna, ×115; Q, adult female, abdominal spiracle, ×500 24

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11. *Auloicerya australis* (Maskell). Adult male. A, Sheath of penis, ×115; B, leg ×57.5; C, apex of abdomen, ×57.5; D, wing, ×30; E, antenna, ×57.5; F, outline of head, ×57.5 25

12. *Auloicerya acaciae*, new species. A, Adult female, outline from below, ×7.5; B, adult female, disk pores, ×1,500; C, larva, dorsal and ventral, ×57.5; D, larva, ventral pore, ×1,500; E, adult female, disk pore, ×1,500; F, larva, dorsal seta, ×220; G, adult female, claw, ×220; H, larva, claw, ×220; I, adult female, antenna, ×57.5 J, larva, disk pore, ×1,500; K, larva, anal tube, ×500 26

13. *Steatococcus nudatus* (Maskell). Adult female. A, Leg, ×57.5; B, abdominal spiracle, ×440; C, antenna, ×57.5; D, claw, ×165; E, section of dorsal derm anteriorly at margin, ×220, with details of pores, ×1,500; F, cross section through abdomen (diagrammatic); G, longitudinal vertical section through body, ×7.5; H, disk pore, ×1,500; I, section of dorsal derm, ×220, with details of pores and seta base, ×1,500; J, outline of body from above, ×12 29

14. *Steatococcus nudatus* (Maskell). Larva. A, Abdominal spiracle, ×1,500; B, dorsal disk pore, ×1,500; C, ventral disk pore, ×1,500; D, antenna, ×115; E, claw, ×440; F, outline, ×57.5; G, leg, ×115 30

15. *Icerya koebelei* Maskell. A, Larva, dorsal and ventral, ×57.5; B, larva, dorsal disk pore, ×1,500; C, larva, ventral disk pore, ×1,500; D, larva, thoracic spiracle, ×500; E, adult female, disk pore, ×1,500; F, adult female disk pores, ×1,500; G, adult male, single antennal segment, ×57.5; H, adult female, portion of ventral pore band near posterior legs, ×220; I, adult female, disk pore from area around vaginal opening, ×1,500; J, larva, claw, ×220; K, larva, leg, ×115; L, adult female, antenna, ×150; M, adult male, apex of abdomen, ×57.5; N, adult female, anterior leg, ×150; O, adult female, claw, ×440; P, adult, female, abdominal spiracle, ×440; Q, adult male, wing, ×17.5 32

16. *Platycoelostoma compressa* (Maskell). A, Adult female, leg, ×57.5; B, intermediate stage female, antenna, ×500; C, intermediate stage female, seta, ×500; D, intermediate stage female, outline from below, ×17.5; E, adult female, seta, ×500; F, intermediate stage female, thoracic spiracle, ×220, with detail of pores, ×1,500; G, adult female, disk pores, ×1,500; H, intermediate stage female, abdominal spiracle, ×220; I, adult female claw, ×220; J, intermediate stage female, disk pore, two views, ×1,500; K, intermediate stage female, ventral cicatrix or simple disk pore, ×1,500; L, adult female antenna, ×57.5; M, intermediate stage female, ventral derm anterior to anal ring, ×220; N, intermediate stage female, middle leg, ×500 36

17. *Platycoelostoma compressa* (Maskell). Larva. A, Dorsal and ventral, ×57.5; B, claw, ×640; C, seta, ×500; D, thoracic spiracle, ×1,500; E, disk pore, ×1,500; F, disk pore, ×1,500; G, antenna, ×57.5; H, leg, ×220. 37

18. *Coelostomidia pilosa* (Maskell). A, Intermediate stage female, outline from above, ×30; B, intermediate stage female, leg, ×220; C, intermediate stage female, anal tube, ×57.5; D, intermediate stage female antenna, ×220; E, intermediate stage female, body spine, ×1,280; F, intermediate stage female, thoracic spiracle, ×220, with detail of pore, ×1,280; G, intermediate stage female, abdominal spiracle, ×220, with detail of pore, ×1,280; H, intermediate stage female, section of derm near margin, ×500, with detail of pore, ×1,500, and of spine, ×1,280; I, adult female, section of derm, ×220, with detail of pore and spine base, ×1,500; J, intermediate stage female, seta, ×460; K, adult female, abdominal spiracle, ×220; L, adult female, tibia and tarsus, ×57.5; M, adult female, claw, ×220; N, *Coelostomidia zealandica* (Maskell), tibia and tarsus, for comparison with L, ×57.5 39

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19. Genus *Callipappus*. A, *C. australis* (Maskell), larva, dorsal, and ventral, ×57.5; B, same, adult female, abdominal spiracle, ×57.5; C, same, larva, apex of abdomen, dorsal and ventral, ×230; D, same, larva thoracic spiracle, ×540; E, *C. immanis* (Maskell), adult female section of dorsal derm, ×220; F, *C. rubiginosus* (Maskell), same as E, and from comparable area, ×220; G, *C. australis* (Maskell) same as E, and from comparable area, ×220; H, *C. australis*, larva, antenna, ×165; I, same, adult female, invaginated seta near inner end of pouch, ×540; J, same, larva, leg, ×165.... 42

MIOCENE PLANTS FROM SOUTHERN MEXICO.

By Edward W. Berry.

1. Location of described Central American Miocene floras................. 3

NEW GENERA OF TWO-WINGED FLIES OF THE SUBFAMILY LEPTOGASTRINAE OF THE FAMILY ASILIDAE.

By J. M. Aldrich.

1. *Eurhabdus zephyreus*, new genus and species, type specimen. Much enlarged. 2. Wing of same more enlarged............................... 2
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THE DRAGONFLIES (ODONATA) OF BURMA AND LOWER SIAM—III. SUBFAMILY AESCHNINAE.

By Frank Fortescue Laidlaw.

1. In the above diagram the boundaries of a region are marked by a double line. The degree of differentiation between areas within the region is indicated by a single line or by a dotted line, according to the clearness of distinction or otherwise. Similarly, the boundaries of the region, where these are not clearly defined, are marked by a single line or by a dotted line. Only the most characteristic genera are entered................ 4

STEIROXYS HENDERSONI, A NEW KATYDID FROM UTAH.

By A. N. Caudell.

1. Cercus of male, dorso-lateral view.. 1

THE MOSQUITOES OF THE UNITED STATES.

By Harrison G. Dyar,
Custodian of Lepidoptera, United States National Museum.

INTRODUCTION.

Mosquitoes are small two-winged flies belonging to the order of Diptera, family Culicidae, subfamily Culicinae. The species are distributed all over the world, from the Arctic regions to the Tropics, but different species and genera are concerned in different faunal regions. The United States as here considered embraces the region between the Canadian and Mexican boundaries, including southern Florida and Alaska. This territory includes three main faunal regions. The first and most northern (except Alaska) is the Canadian zone. The mosquitoes of this region were treated in a separate paper by the writer.[1] This paper includes all mosquitoes reported from Canada, and not only those belonging to the Canadian zone proper. However, this paper will be more useful for the parts of the United States where the Canadian species are dominant than the present one, and the reader is accordingly recommended to it. The parts of the United States referred to are, roughly, northern Maine, the mountains of New England and New York, northern Minnesota, the mountains of Montana, and the higher parts of the Rocky Mountain chain to Colorado and the Yukon Valley in Alaska, above the southward bend of the river. The mountains bordering the Pacific coast, the Cascades and Sierra Nevada, have the Canadian fauna considerably modified, and are not covered by the paper referred to. They will be found included here.

The second faunal region comprises the coastal area on the Pacific between the mountains and the sea, beginning in Washington State and extending up the coast at least to Cape Fanshaw, Alaska. Above the area where the coast is bordered by islands, two more regions are indicated, but the country is insufficiently explored to permit of positive conclusions.

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[1] Dyar, H. G., The Mosquitoes of Canada, Transactions of the Royal Canadian Institute, vol. 13, pp. 71–120, 1921.

The third faunal complex is of southern origin and extends upward from Mexico through the Mississippi Valley. The species are in general adapted to arid conditions, and present a contrast to the species of the Canadian fauna, which are adapted to conditions in which melted snow forms a prominent factor. This contrast is best shown in those species which depend upon temporary water. Species addicted to permanent water are naturally more independent of conditions of moisture or aridity, and their distribution depends more upon temperature. Thus in America the tropical area from about latitude 35° south to 35° north is inhabited by *Culex quinquefasciatus*. North and south of 35°, respectively, *Culex pipiens* occurs, and the two are coexistent for only a small distance. These are species dependent upon permanent water, and their distribution is governed by temperature conditions. On the other hand, *Aëdes punctor* is dominant in the Canadian zone, and gives rise to derivative forms in the coastal region and California mountains, but it is not found at all outside of the forested area, the *Aëdes* of the south belonging to wholly different groups. These are species depending upon temporary water, in the one case snow water, in the other case casual rains, and the adaptations are wholly different. Distribution here depends upon moisture, not temperature.

The principal diseases conveyed by mosquitoes in the United States are malaria and yellow fever. The danger of the former is everywhere present, the disease being conveyed by at least three species of *Anopheles*, with somewhat different capacities of carriage. The latter is only dangerous in times of epidemic, happily becoming scarce. The mere presence of the carrying species, *Aëdes aegypti*, is therefore not necessarily a subject for alarm.

The nomenclature adopted is that indicated in our standard American work.[3] Certain differences maintained by European writers will be mentioned.

Theobaldia instead of *Culiseta* as here used. There exists an earlier *Theobaldius*, which is held by the European writers not to invalidate *Theobaldia*. It is pointed out that there is no rule to this effect. It seems to us, however, that this similarity is confusing, and it is desirable to have names as assistance to study rather than the reverse. The difference consists in a gender termination, which in the case of species is never considered a sufficient difference.

Taeniorhynchus instead of *Mansonia* as here used. Lynch Arribálzaga founded *Taeniorhynchus* on a species which he considered to be *taeniorhynchus* Wiedemann, but which has been shown to have been *titillans* Walker, the former an *Aëdes*, the latter a *Mansonia*.

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[3] Howard, Dyar, and Knab, The Mosquitoes of North and Central America and the West Indies, 1912–1917.

We took the type to be the species mentioned by Lynch; but European writers consider the type to have been the species actually before the author at the time. *Taeniorhynchus* is thus considered a synonym (or subgenus) of *Aëdes* by us; for the European writers the name replaces *Mansonia.*

Heteronycha as a synonym (or subgenus) of *Aëdes* or of *Culex.* Lynch Arribálzaga described *Heteronycha dolosa* in such a way that it appears that he had a male *Culex* and a female *Aëdes* before him, wrongly associated as one species. In the monograph, we restrict *Heteronycha* to the *Aëdes* element, discussing the matter at length. It has since been pointed out to me that *Heteronycha* was previously restricted to the *Culex* element, and by the principle of the first reviser we were not at liberty to take the action mentioned. However, the so-called previous revision consists only in the reference to the synonymy of *Heteronycha dolosa* to *Culex fatigans* by Theobald.[3] There is not a word of explanation or of comment, and Lynch's contrary diagnosis of the female is ignored. Moreover, the male before Lynch was not *Culex fatigans*, but a different species, since described as *Culex bonariensis* Brèthes. Therefore Theobald's reference is wholly in error, the female which he calls *fatigans* being not a *Culex*, but an *Aëdes* (*Aëdes lynchii* Brèthes), while the male he calls *fatigans* is another species (*bonariensis*). Can a mere indication of an erroneous synonymy be characterized properly as the work of the first reviser? If so *Heteronycha* should be a synonym of *Culex.* Otherwise the use of the name as a subgenus of *Aëdes* as here done is indicated.

Culex fatigans instead of *Culex quinquefasciatus.* The name *quinquefasciatus* is older than *fatigans*, but the identity of the former is called in question. No certain types exist. Say's description is brief, but is said by European writers to suggest an *Anopheles*, because, he says, "body clothed with cinereous hair." I do not think that at that time a fine distinction would be drawn between hairs of *Anopheles* and the narrow curved scales of *Culex.* The fact that Say says the legs are short and the abdomen banded would seem to exclude *Anopheles* and fix the present species, and also the deciduous mesonotal vestiture, which does not exist in *Anopheles.*

In this paper the trinomial subspecific nomenclature has not been adopted. All subspecies are here classified as species; but where forms have been considered as subspecies the fact is mentioned in each case.

The terminology of the parts of the male genitalia proposed by Edwards[4] has been adopted in this paper, superseding the one used in the monograph and the modification of it in the paper on Canadian mosquitoes.

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[3] Mon. Culic., vol. 2, p. 151, 1901.

[4] Ann. Trop. Med. & Par., vol. 14, pp. 23–40, 1920.

KEY TO THE TRIBES AND GENERA OF THE MOSQUITOES OF THE UNITED STATES.

Metanotum with a tuft of setae.........Tribe **Sabethini.**
Genus **Wyeomyia** Theobald.
Metanotum nude.........Tribe **Culicini.**
1. Wings with the second marginal cell less than half as long as its petiole......... 2.
Wings with the second marginal cell over half as long as its petiole......... 3.
2. Proboscis rigid, down curved.........Genus **Megarhinus** Robineau-Desvoidy.
Proboscis flexible, normal.........Genus **Uranotaenia** Lynch Arribalzaga.
3. Scutellum rounded, not lobed.........Genus **Anopheles** Meigen.
Scutellum distinctly trilobed......... 4.
4. Cross veins tending to lie in line, the posterior close to the anterior, or mesonotum with bare impressed discolorous lines, or both.
Genus **Culiseta** Felt.
Cross veins normal; mesonatol integument without impressed discolorous lines......... 5.
5. Fourth joint of fore tarsus very short...Genus **Orthopodomyia** Theobald.
Fourth joint of fore tarsus longer, normal......... 6.
6. Second joint of antennae very long in both sexes, those of the male similar to the female.........Genus **Deinocerites** Theobald.
Second joint of antennae short; antennae of male dissimilar to those of the female......... 7.
7. Abdomen of female blunt, with short cerci; hypopygium of male with the side pieces curved down, or shortly projecting......... 8.
Abdomen of the female pointed, cerci exerted; hypopygium of male with the side pieces prominently projecting, straight......... 9.
8. Wing scales narrow, normal.........Genus **Culex** Linnaeus.
Wing scales distinctly large and broad.........Genus **Mansonia** Blanchard.
9. Abdomen of female with the eighth segment wholly retractile, nude; male claspette with multiple terminal appendages.
Genus **Psorophora** Robineau-Desvoidy.
Abdomen of female with the eighth segment only partly retractile; male claspette with only a single appendage, or claspette wanting.
Genus **Aedes** Meigen.

Tribe SABETHINI.

The mosquitoes of this tribe are almost wholly tropical. Their larvae live in the water that collects in plants, either living or dead, such as the leaf bases of Bromeliaceae, flower bracts of Heliconia, cavities in tree trunks, cocoanut shells, cacoa shells, and palm spathes. In some instances this water is rendered thick and gummy by the exudations of the plants, and in others it is foul and opaque. Two species occur in the United States in Bromeliaceae, and a third in the pitcher plant, with a northern distribution.

Genus WYEOMYIA Theobald.

Wyeomyia THEOBALD, Journ. Trop. Med., vol. 4, p. 233, 1901.
Phoniomyia THEOBALD, Mon. Culic., vol. 3, p. 311, 1903.

Dendromyia THEOBALD, Mon. Culic., vol. 3, p. 313, 1903.
Miamyia DYAR, Ins. Ins. Mens., vol. 7, p. 116, 1919.
Dinomyia DYAR, Ins. Ins. Mens., vol. 7, p. 117, 1919.
Triamyia DYAR, Ins. Ins. Mens., vol. 7, p. 120, 1919.
Pentemyia DYAR, Ins. Ins. Mens., vol. 7, p. 122, 1919.
Heliconiamyia DYAR, Ins. Ins. Mens., vol. 7, p. 123, 1919.
Diphalangarpe DYAR, Ins. Ins. Mens., vol. 7, p. 126, 1919.
Cleobonnea DYAR, Ins. Ins. Mens., vol. 7, p. 135, 1919.
Decamyia DYAR, Ins. Ins. Mens., vol. 7, p. 135, 1919.
Calladimyia DYAR, Ins. Ins. Mens., vol. 7, p. 137, 1919.
Dodecamyia DYAR, Ins. Ins. Mens., vol. 7, p. 136, 1919.
Lemmamyia DYAR, Ins. Ins. Mens., vol. 7, p. 140, 1919.
Hystatomyia DYAR, Ins. Ins. Mens., vol. 7, p. 140, 1919.
Dyarina BONNE-WEPSTER and BONNE, Ins. Ins. Mens., vol. 9, p. 6, 1921.

A large genus of tropical distribution, most of the species addicted to the water in the leaves of Bromeliaceae. The genus has been subdivided into subgenera on the characters of the male genitalia. Those occurring in the United States separate as follows:

1. Stem of clasper short, irregular………………Subgenus **Dendromyia** Theobald.
   Stem of clasper long and slender………………Subgenus **Wyeomyia** Theobald.

KEY TO THE UNITED STATES SPECIES OF WYEOMYIA.

1. Prothoracic lobes silvery………………………………**vanduzeei** Dyar and Knab.
   Prothoracic lobes violet blue………………………………………………**2**
2. Mid and hind tarsi marked with white in the female……**mitchellii** Theobald.
   Mid tarsi only marked with white in the female……………**smithii** Coquillett.

Subgenus WYEOMYIA Theobald.

WYEOMYIA (WYEOMYIA) MITCHELLII Theobald.

Dendromyia mitchellii THEOBALD, Mosq. or Culic. of Jam., p. 37, 1905.
Wyeomyia ochrura DYAR and KNAB, Journ. N. Y. Ent. Soc., vol. 14, p. 227, 1906.
Wyeomyia antoinetta DYAR and KNAB, Smith. Misc. Colls., quart. iss., vol. 52, p. 263, 1909.

A small stout mosquito with dark mesonotum and violet prothoracic lobes, the mid legs with the distal half of second tarsal joint, the third to fifth silvery white, the hind legs with small white spots at the bases of the tarsal joints beneath, the latter occasionally absent (*antoinetta* Dyar and Knab). Abdomen black above, silvery white below, the colors separated on the sides in a straight line. Patches of silvery white scales on the sides. A small group of bristles on the posterior side of the metanotum.

The larvae live in the water that collects in the leaf bases of epiphytic Bromeliaceae, which adorn the limbs of the higher trees in tropical Florida. The life history has not been minutely observed.

Distribution.—The Greater Antilles and southern Florida.

United States Records.

FLORIDA: Estero, May 10, 1906 (J. B. Van Duzee).
Royal Palm Park, April 30, 1918 (C. A. Mosier).
Cocoanut Grove, March 24, 1917 (T. E. Snyder).
Miami Beach, April 9, 1917 (T. E. Snyder).
Homestead, March 12, 1917 (C. A. Mosier).

Subgenus DENDROMYIA Theobald.

WYEOMYIA (DENDROMYIA) VANDUZEEI Dyar and Knab.

Wyeomyia vanduzeei DYAR and KNAB, Proc. Biol. Soc. Wash., vol. 19, p. 138, 1906.

Wyeomyia bahama DYAR and KNAB, Proc. Biol. Soc. Wash., vol. 19, p. 138, 1906.

Wyeomyia argyrura DYAR and KNAB, Proc. U. S. Nat. Mus., vol. 24, p. 70, 1908.

Wyeomyia conchita DYAR and KNAB, Smith. Misc. Colls., quart. iss., vol. 52, p. 264, 1909.

A small stout mosquito with dark mesonotum, the prothoracic lobes silvered. Legs dark, the mid tarsi marked with silvery white at tip of second joint and all of third to fifth. Abdomen black above, silvery at extreme tip and beneath, the colors separated on the sides in a straight line. Patches of silvery white scales on the sides. A small group of minute bristles on the posterior side of the metanotum.

The larvae live in the water that collects in the bases of the leaves of epiphytic Bromeliaceae. They occur all the year around, provided that water remains in the leaves.

The adult will bite, although not with ferocity. The writer was bitten by one while stooping over a pool for some time.

Distribution.—Cuba, the Bahamas, and southern Florida.

United States Records.

FLORIDA: Estero, April and May, 1906 (J. B. Van Duzee).
Osprey, July 19 and August 31, 1901 (J. G. Webb).
Biscayne Bay, ——— (A. T. Slosson).
Paradise Key, March 27, 1917 (T. E. Snyder).

WYEOMYIA (DENDROMYIA) SMITHII Coquillett.

Aëdes smithii COQUILLETT, Can. Ent., vol. 33, p. 260, 1901.

A small stout mosquito with dark mesonotum and legs, mid tarsi marked with white from apex of second joint to fifth. Abdomen black above, silvery white below, the colors separated on the sides in a straight line. Prothoracic lobes submetallic blue. Patches of silvery white scales on the sides. A small group of minute bristles on the posterior side of the metanotum.

The larvae live in the water in the leaves of pitcher plants (*Sarracenia purpurea*), passing the winter frozen up in the ice cores. The eggs are laid on the still, dry, newly opened leaves, and hatch when water collects in them.

The mosquito is rarely met with except by breeding from pitcher-plant leaves. It has not been recorded as biting; but as many of the tropical species attack warm-blooded animals, this may be found to do so.

Distribution.—Canada to Alabama, probably coextensive with the range of the host plant, *Sarracenia purpurea.*

United States Records.

NEW HAMPSHIRE: Dublin, August, 1909 (H. G. Dyar).
MASSACHUSETTS: Westfield, July and August, 1909 (F. Knab).
Springfield, ——— (G. Dimmock).
NEW YORK: Tupper Lake, August, 1905 (H. G. Dyar).
NEW JERSEY: Lahaway, April 24, 1901 (J. T. Brakeley).
MARYLAND: Baltimore, November, 1901 (Dr. Coker).
DISTRICT OF COLUMBIA: Washington, ——— (E. G. Mitchell).
NORTH CAROLINA: Boardman, April, 1904 (A. D. Hopkins).
SOUTH CAROLINA: Swansea, August 11, 1911 (F. Knab).
ALABAMA: Theodore, April, 1910 (F. M. Jones).
ILLINOIS: Cedar Lake, June, 1892 (S. A. Forbes).
WISCONSIN: Crab Lake, November, 1907 (H. S. Barber).

Tribe CULICINI.

This tribe includes the bulk of the mosquitoes, and all of those of typically northern distribution. Only the lowest members, such as *Orthopodomyia*, *Megarhinus*, and the lower subgenera of *Aëdes*, live in water in plant tissues, such as the tree holes; most of the species inhabit ground puddles. The species and genera are variously differentiated. *Aëdes* inhabits temporary puddles, especially water left from the melting snow in spring, and these species have in general but a single annual generation. *Culex* and *Culiseta* inhabit pools of a generally permanent character, and overwinter as adults. *Anopheles* larvae are surface feeders, and consequently the character of the water makes less difference to them. They have been found in all sorts of water, even in running streams, but the different species are variously restricted.

Genus DEINOCERITES Theobald.

Deinocerites THEOBALD, Journ. Trop. Med., vol. 4, p. 235, 1901.
Brachiosoma THEOBALD, Journ. Trop. Med., vol. 4, p. 235, 1901.
Brachiosoma THEOBALD, Mon. Culic., vol. 2, p. 215, 1901.
Dinomimetes KNAB, Journ. N. Y. Ent. Soc., vol. 15, p. 120, 1907.
Dinanamesus DYAR and KNAB, Smith Misc. Colls., quart. iss., vol. 52, p. 259, 1909.

A genus of tropical distribution, all of the species of which live in the water in the holes of certain species of crabs which inhabit marshes along the shore. Three genera were formed on the modifications of the antennae and the presence or absence of setae on the metanotum; but it seems best to consider these subdivisions as of only subgeneric rank. A single species occurs in southern Florida, which belongs to *Deinocerites* proper.

The water remains permanently in the holes of the crab, and the adult mosquitoes rest in the upper dry part of the hole. It has been surmised that the peculiar long antennae of the mosquito is an adaptation to present a large sensory surface so that the individuals can detect the approach of the crab in time to fly out of the hole before being overwhelmed in the water by the inrush of the crustacean.

DEINOCERITES (DEINOCERITES) CANCER Theobald.

Deinocerites cancer THEOBALD, Mon. Culic., vol. 2, p. 215, 1901.
Brachiomyia magna THEOBALD, Mon. Culic., vol. 2, p. 344, 1901.

A rather large blackish mosquito, entirely dark, venter dull brown. Abdomen blunt, but the cerci stout and prominent in the female, the male claspers large. Mesonotum coarsely hairy. Pleurae dark brown, the incisions testaceous.

The larvae inhabit crab holes near the sea, generally filled with brackish water. No exact observations on the life history are of record. The species is not known to bite.

Distribution.—Littoral of the Greater Antilles and southern Florida.

United States Records.

FLORIDA: Miami, May 23, 1905 (Dyar and Caudell).
Miami, October 3, 1921 (G. F. Moznette).

Genus CULEX Linnaeus.

Culex LINNAEUS, Syst. Nat., ed. 10, p. 602, 1758.
Lutzia THEOBALD, Mon. Culic., vol. 3, p. 155, 1903.
Melanoconops THEOBALD, Mon. Culic., vol. 3, p. 178, 1903.
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Melanoconion THEOBALD, Mon. Culic., vol. 3, p. 238, 1903.
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Gnophodeomyia THEOBALD, Journ. Econ. Biol., vol 1., p. 21, 1905.
Trichopronomyia THEOBALD, Ann. Nat. Mus. Hung., vol. 3, p. 98, 1905.
Carrollia LUTZ, Imp. Med., p. 81, 1905.
Pseudoheptaphlebomyia VENTRILLON, Bull. Mus. Nat. Hist., Paris, p. 427, 1905.
Isostomyia COQUILLETT, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 11, p. 16, 1906.
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Culiciomyia Theobald, Mon. Culic., vol. 4, p. 227, 1907.
Aporoculex Theobald, Mon. Culic., vol. 4, p. 150, 1907.
Pseudoculex Theobald, Mon. Culic., vol. 4, p. 318, 1907.
Leucomyia Theobald, Mon. Culic., vol. 4, p. 372, 1907.
Microculex Theobald, Mon. Culic., vol. 4, p. 461, 1907.
Oculeomyia Theobald, Mon. Culic., vol. 4, p. 515, 1907.
Neomelanoconion Newstead, Dutton, and Todd, Ann. Trop. Med. Par., vol. 1, p. 31, 1907.
Pectinopalpus Theobald, Ann. Mag. Nat. Hist., ser. 8, vol. 5, p. 375, 1910.
Eumelanomyia Theobald, Mon. Culic., vol. 5, p. 114, 1910.
Phalangomyia Dyar and Knab, Ins. Ins. Mens., vol. 2, p. 58, 1914.
Climacura Howard, Dyar, and Knab, Mosq. N. & Cent. Am. & W. I., vol. 3, p. 452, 1915.
Transculicia Dyar, Ins. Ins. Mens., vol. 5, p. 184, 1917.
Caroculex Dyar, Ins. Ins. Mens., vol. 6, p. 100, 1918.
Choeroporpa Dyar, Ins. Ins. Mens., vol. 6, p. 103, 1918.
Helcoporpa Dyar, Ins. Ins. Mens., vol. 6, p. 125, 1918.
Eubonnea Dyar, Ins. Ins. Mens., vol. 7, p. 150, 1919.
Barraudius Edwards, Bull. Ent. Res., vol. 12, p. 332, 1921.

A genus of world-wide distribution, especially strong in the Tropics and warmer temperate regions, but few species extending far north. The larvae inhabit water of a permanent nature, some species taking kindly to water in artificial containers. Such species are liable to be abundant and troublesome in cities, and take on a semidomesticated nature. Many species habitually transmit blood diseases of birds and animals, but they do not play an important role in human diseases. Several transmit *Filaria*.

The subgenera occurring in the United States separate as follows on the characters of the male genitalia:

1. Tenth sternites few toothed..........Subgenus **Climacura** Howard, Dyar, and Knab.
   Tenth sternites tufted with spines.. 2.
   Tenth sternites flattened, comb shaped.. 3.
2. Mesosome simple, one plate with a bridge..........Subgenus **Neoculex** Dyar.
   Mesosome with complex series of plates..........Subgenus **Culex** Linnaeus.
3. Clasper simple, uniform....................Subgenus **Melanoconion** Theobald.
   Clasper modified, enlarged at tip.. 4.
4. Clasper elongated, with snout-like termination..Subgenus **Choeroporpa** Dyar.
   Clasper bluntly rounded, with subspherical tip.
   Subgenus **Mochlostyrax** Dyar and Knab.

KEY TO THE UNITED STATES SPECIES OF CULEX.

1. Proboscis white ringed in the female.. 2.
   Proboscis not, or nor completely white-ringed.. 4.
2. White rings of the tarsi broad.. 3.
   White rings of the tarsi narrow.......................... {**corniger** Theobald.
   { **thriambus** Dyar.
3. Femora and tibia with a fine white line on outer side.....**tarsalis** Coquillett.
   These parts black on outer side..........................**stigmatosoma** Dyar.

4. Tarsi with white rings at both ends of the joints.. **coronator** Dyar and Knab.
thriambus Dyar.
Tarsi unbanded ---------- 5.
5. Abdomen with apical segmental white marking---- **testaceus** van der Wulp.
Abdomen with white marking basal on segments or absent---------- 6.
6. Recumbent scales of occiput narrowly curved or lanceolate---------- 7.
These scales at least in part broad and subtruncate---------- 13.
7. Mesonotum red; abdomen with the bands indistinct---- **erythrothorax** Dyar.
Not so colored---------- 8.
8. Scales on forks of second vein broad and ovate---------- **melanurus** Coquillett.
These scales narrow, ligulate---------- 9
9. Abdomen with basal segmental white bands---------- 10
Abdomen unbanded dorsally---------- 12
10. Band of second abdominal segment triangularly produced---------- 11
This band transverse---------- **territans** Walker.
11. Abdominal bands joined to the lateral spots---------- **pipiens** Linnaeus.
Abdominal bands separated from the lateral spots---- **quinquefasciatus** Say
12. Lateral spots of the abdomen not visible dorsally---- **salinarius** Coquillett.
These spots visible dorsally---------- **similis** Theobald.
13. Mesonotum more or less golden---------- 14.
Mesonotum brown ---------- 15.
14. Mesonotum bright golden (from Texas)---------- **pose** Dyar and Knab.
Mesonotum moderately golden.. **egberti** Dyar and Knab.
degustator Dyar.
errationis Dyar and Knab.
homoeopas Dyar and Ludlow.
15. Scales on forks of second vein ligulate---------- **anips** Dyar.
These scales ovate.. **peccator** Dyar and Knab.
floridanus Dyar and Knab.

KEY TO THE UNITED STATES SPECIES OF CULEX BY THE MALE GENITALIA.

(*Culex* and *Choeroporpa*.)

1. (*Culex*) Lobe of sidepiece with three rods, a seta or filament, a leaf and a seta ---------- 2.
This part with additional appendages---------- 4.
2. Mesosomal plate with two broad arms and a central mass of close denticles. Group **Corniger**.
This plate not so formed---------- 3.
3. Upper limb of mesosomal plate denticulate---------- Group **Tarsalis**.
This limb entire---------- Group **Salinarius**.
Mesosomal plate of two blunt teeth---------- Group **Territans**.
4. Lobe of sidepiece with three rods, two setae, a filament, a leaf, and a seta. Group **Pipiens**.
Lobe of sidepiece without a leaf, divided---------- Group **Coronator**.
5. (*Choeroporpa*) clasper with a horn-like tuft before tip; terminal spine uniform ---------- 6.
Without this structure; terminal spine generally widened and appendiculate---------- 8.
6. Anterior crest of clasper of appressed or consolidated spines---------- 7.
This crest composed of fine hairs---------- **anips** Dyar.

7. Terminal spine of clasper stout; anterior crest solid. **erraticus** Dyar and Knab.
This spine delicate; anterior crest of compressed spines. **peccator** Dyar and Knab.
8. Third spine of mesosomal plate subapical ____________ **pose** Dyar and Knab.
This spine medial on the stem ____________ 9.
9. Spine of clasper larger; ninth tergites broader, remote. **egberti** Dyar and Knab.
Spine of clasper smaller; ninth tergites narrower, obliquely approximated. **degustator** Dyar.

Subgenus MOCHLOSTYRAX Dyar and Knab.

CULEX (MOCHLOSTYRAX) FLORIDANUS Dyar and Knab.

Mochlostyrax cubensis DYAR and KNAB (not Bigot), Jour. N. Y. Ent. Soc., vol. 14, p. 223, 1906.

Mochlostyrax floridanus DYAR and KNAB, Proc. Biol. Soc. Wash., vol. 19, p. 171, 1906.

Culex agitator DYAR and KNAB, Journ. N. Y. Ent. Soc., vol. 15, p. 100, 1907.

Culex deceptor DYAR and KNAB, Smith. Misc. Colls., Quart. iss., vol. 52, p. 257, 1909.

Culex mastigia HOWARD, DYAR, and KNAB, Mosq. No. & Cent. Amer. & W. I., vol. 3, p. 426, 1915.

A very small black mosquito. Mesonotum dark brown, legs blackish, abdomen with or without basal segmental whitish bands, lateral spots present. Very uncharacteristic in markings, but distinct on the characters of larvae and male genitalia.

The larvae live in permanent water with aquatic vegetation. They have the habit of hanging themselves up on leaves, etc., by the hooks of the air tube, or often lie on the bottom, seldom coming to the surface. No observations are on record of the biting habits. The species is rare and insufficiently studied in its habits.

Distribution.—Cuba and southern States.

United States Records.

NORTH CAROLINA: Charlotte, July and August, 1915 (H. P. Barret).
FLORIDA: Estero, July 1906 (J. B. Van Duzee).
Miami, December 13, 1921 (G. F. Moznette).

Subgenus CHOEROPORPA Dyar.

CULEX (CHOEROPORPA) POSE Dyar and Knab.

Culex (*Mochlostyrax*) *pose* DYAR and KNAB, Ins. Ins. Mens., vol. 5, p. 182, 1917.

A small blackish mosquito with bright golden mesonotum. The gold color may contain two small brown spots before and be streaked with brown behind. The abdomen has distinct white bands at the bases of the segments, pointed in the middle. Wing scales on forks of second vein ligulate. The larva is unknown.

Distribution.—Central Texas and Louisiana.

United States Records.

TEXAS: Dallas, November 11, 1905 (W. E. Hinds).
Kelly Field, San Antonio, 1918 (S. M. Dohanian).
LOUISIANA: Mound, April 21, 1921 (G. H. Bradley).

CULEX (CHOEROPORPA) ERRATICUS Dyar and Knab.

Mochlostyrax erraticus DYAR and KNAB, Journ. N. Y. Ent. Soc., vol. 14, p. 223, 1906.

Culex abominator DYAR and KNAB, Smith. Misc. Colls., Quart. iss., vol. 52, p. 257, 1909.

A small black mosquito, the mesonotum dark brown, with more or less of a golden tint. Abdomen dark dorsally, with variable bands and white lateral segmental spots, banded black and white below. The markings are uncharacteristic, the species only to be certainly differentiated by the male genitalia or larvae.

The larvae live in permanent bodies of water full of aquatic vegetation. The adult bites annoyingly in woods by the margins of ponds and streams. The eggs are laid quite firmly attached to a leaf or other object in the water.

Distribution.—Mississippi Valley and Texas. Some of the records below are uncertain in the absence of males.

United States Records.

ILLINOIS: Havana (R. B. Coad).
TENNESSEE: Rives, July 27, 1904 (H. S. Barber).
ARKANSAS: Little Rock, August 6, 1914 (J. A. LePrince).
Scott, October 8, 1908 (J. K. Thibault).
Fort Smith, July 7, 1904 (H. S. Barber).
MISSISSIPPI: Tutwiler, August 2, 1904 (H. S. Barber).
LOUISIANA: Baton Rouge (J. W. Dupree).
TEXAS: Plano, September (E. S. Tucker).
Victoria, July 28, 1904 (E. G. Hinds).
Brownsville, June 7, 1904 (H. S. Barber).

CULEX (CHOEROPORPA) PECCATOR Dyar and Knab.

Culex peccator DYAR and KNAB, Smith. Misc. Colls., Quart. iss., vol. 52, p. 256, 1909.

Culex incriminator DYAR and KNAB, Smith. Misc. Coll., quart. iss., vol. 52, p. 257, 1909.

A small blackish mosquito, the mesonotum dark brown. Abdomen dark brown dorsally, with white basal segmental spots on the sides. Venter black and white banded, but indistinctly. The markings are uncharacteristic. The species is a close ally of *erraticus*, replacing it in the Atlantic region, but on account of distinct differences in the genitalia to be considered as a good species. The larva is much like that of *erraticus*, and the habits, so far as known, similar.

Distribution.—Atlantic and Gulf coastal regions.

United States Records.

GEORGIA: Augusta, August 26, 1918 (W. H. Dumont).
NORTH CAROLINA: Charlotte, August 24, 1917 (H. P. Barret).
Rockingham, September, 1921 (H. P. Barret).
Jacksonville, July 21, 1920 (H. P. Barret).
SOUTH CAROLINA: Hartsville, June 24, 1914 (J. A. LePrince).
TENNESSEE: Rives, July 27, 1904 (H. S. Barber).
ARKANSAS: Scott, September and October, 1908 (J. K. Thibault).
Little Rock, July 11, 1904 (H. S. Barber).
MISSISSIPPI: Jackson Barracks, October 16, 1920 (Army Medical Museum).
Agricultural College, August 18, 1905 (W. V. Reed).
Tutwiler, August 2, 1904 (H. S. Barber).
Scott, May 5, 1915 (M. B. Mitzmain).

CULEX (CHOEROPORPA) EGBERTI Dyar and Knab.

Culex egberti DYAR and KNAB, Journ. N. Y. Ent. Soc., vol. 15, p. 214, 1907.
Culex (Mochlostyrax) peribleptus DYAR and KNAB, Ins. Ins. Mens., vol. 5, p. 181, 1917.

A small dark mosquito, the mesonotum dark brown with traces of golden tint. Abdomen dark dorsally, with more or less distinct dorsal white dots, especially on second segment, and white lateral spots. Venter black and white banded, but indistinctly. The markings are uncharacteristic, the species only to be certainly differentiated by the male genitalia.

The larvae live in permanent water containing grass or other vegetation. The habits of the adults have not been described.

Distribution.—Florida and the southern Atlantic and Gulf coasts.

United States Records.

SOUTH CAROLINA: Parr Shoals, August 16, 1915 (T. D. H. Griffitts).
FLORIDA: Lake Okeechobee, January 1, 1906 (J. H. Egbert).
Miami, November 1, 1921 (G. F. Moznette).
Jacksonville, October 12, 1908 (H. Byrd).
MISSISSIPPI: Sibley, July 27, 1921 (A. Fleming).

CULEX (CHOEROPORPA) DEGUSTATOR Dyar.

Culex (Choeroporpa) degustator DYAR, Ins. Ins. Mens., vol. 9, p. 89, 1921.

A small blackish mosquito, the mesonotum dark brown with traces of golden tint. Abdomen dark dorsally, with white lateral spots. Venter black and white banded. The markings are uncharacteristic. This differs only slightly in genetalic characters from *egberti*. It may be considered as a local form or subspecies of this. The larva has not been described.

Distribution.—Mississippi Valley.

United States Records.

ILLINOIS: Herrin, August 27, 1920 (S. C. Chandler).
MISSOURI: Belmont, June 14, 1918 (L. Haseman).
ARKANSAS: Scott, August 11, 1909 (J. K. Thibault).
LOUISIANA: Como, August 20, 1901 (G. E. Beyer).
ALABAMA: Mobile, June 9, 1915 (R. H. von Ezdorf).

CULEX (CHOEROPORPA) ANIPS Dyar.

Culex anips DYAR, Ins. Ins. Mens., vol. 4, p. 48, 1916.

A small blackish mosquito, the mesonotum dark reddish brown. Abdomen black above, with lateral segmental basal white spots; venter grayish, very indistinctly banded. Legs black, except the femora beneath. Wing scales narrow. Very uncharacteristically marked, but easily told by the distribution, being the only *Culex* of this group from the west coast of the United States. The larva is unknown, as also the habits of the adult. The original specimens were obtained from pupae collected in a large pond in the valley of the San Diego River, the pond deep in the middle and containing fish.

Distribution.—Southern California.

United States Records.

CALIFORNIA: San Diego, May 3, 1916 (H. G. Dyar).

Subgenus MELANOCONION Theobald.

CULEX (MELANOCONION) HOMOEOPAS Dyar and Ludlow.

Culex (*Melanoconion*) *homoeopas* DYAR AND LUDLOW, Ins. Ins. Mens., vol. 9, p. 46, 1921.

A small blackish mosquito, the mesonotum dark brown with golden tint. Abdomen dark, with broad whitish segmental basal bands in the male. Venter black, with narrow white bands at the bases of the segments. Wing scales narrowly ovate in the male, probably broader in the female. An obscurely marked species, distinguished by the male genitalia, and known in only a single male, captured near New Orleans, where it may have flown ashore from a steamer from Bluefields, Nicaragua, or other southern port.

Distribution.—Unknown.

United States Records.

LOUISIANA: Jackson Barracks, October 16, 1920 (C. C. Robbins).

Subgenus NEOCULEX Dyar.

CULEX (NEOCULEX) TESTACEUS van der Wulp.[5]

Culex testaceus VAN DER WULP, Tidsc. voor Ent., ser. 2, vol. 10, p. 128, 1867.
Culex apicalis ADAMS, Kans. Univ. Sci. Bull., vol. 2, p. 26, 1903.

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[5] This species was for a long time called *Culex territans*; but that name has lately been shown to belong to another species, formerly known as *Culex restuans*.

Culex sergenti THEOBALD, Mon. Culic., vol. 3, p. 218, 1903.
Culex saxatilis GROSSBECK, Can. Ent., vol. 37, p. 360, 1905.
Culex frickii LUDLOW, Can. Ent., vol. 38, p. 132, 1906.
Culex pyrenaicus BROLEMANN, Ann. Soc. Ent. France, vol. 87, p. 427, 1919.

A small blackish mosquito, readily distinguished by the white abdominal bands being apical on the segments instead of basal, though sometimes very narrow. Mesonotum with bronzy brown scales and sometimes a pair of light spots near the middle. Proboscis and legs blackish scaled, the femora whitish beneath. Wing scales narrow and hairlike, wholly dark.

The male genitalia have the mesosomal plate simple, the pair united by a bridge in a characteristic manner. Lobe of the sidepiece with two capitate rods, three flattened setae and three normal setae.

The larvae occur in grassy marshes, and can be found all summer. The adults do not bite warm-blooded animals, but have been observed attacking frogs.

Distribution.—North America, from Mexico to Canada; Europe.

United States Records.

MAINE: Lincolnville, August, 1908 (H. G. Dyar).
MASSACHUSETTS: Westfield, August 25, 1903 (F. Knab).
RHODE ISLAND: Weekapaug, July 5, 1904 (H. G. Dyar).
NEW YORK: Bellport, August, 1902 (H. G. Dyar).
Tupper Lake, August 20, 1905 (H. G. Dyar).
Ithaca, September, 1901 (O. A. Johannsen).
NEW JERSEY: Lahaway, August (J. T. Brakeley).
PENNSYLVANIA: Norristown, July 18 (H. L. Viereck).
MARYLAND: Baltimore, June 8, 1904 (Dyar and Caudell).
DISTRICT OF COLUMBIA: Washington, June, 1903 (F. C. Pratt).
VIRGINIA: Falls Church, May 6, 1903 (H. G. Dyar).
FLORIDA: West Tampa, March 18, 1905 (Dyar and Caudell).
Jacksonville, March 4, 1905 (Dyar and Caudell).
Miami, March 7, 1905 (Dyar and Caudell).
IOWA: Ames, July 18, 1906 (H. J. Quayle).
ILLINOIS: Urbana, September, 1904 (F. Knab).
MISSOURI: St. Louis, August, 1904 (A. Busck).
ARKANSAS: Scott, October 8, 1908 (J. K. Thibault).
LOUISIANA: Baton Rouge (J. W. Dupree).
NEW MEXICO: Las Vegas Hot Springs, August 11 (H. S. Barber).
CALIFORNIA: San Diego, May 7, 1916 (H. G. Dyar).
Pasadena, June 30, 1906 (H. G. Dyar).
Stanford University (I. MacCracken).
Sisson, July 23, 1906 (Dyar and Caudell).

Subgenus CULEX Linnaeus.

Group CORONATOR.

CULEX (CULEX) CORONATOR Dyar and Knab.

Culex coronator Dyar and Knab, Journ. N. Y. Ent. Soc., vol. 14, p. 215, 1906.
Culex (Culex) usquatus Dyar, Ins. Ins. Mens., vol. 6, p. 122, 1918.

A medium-sized blackish mosquito, with brown mesonotum, usually unornamented. Proboscis dark above in the female, ringed with white in the male. Abdomen black above, with rather narrow basal segmental white bands, widening in the middle; venter whitish, with few black scales toward apices of segments. Legs blackish, the femora and tibiae white on the under side; tarsi ringed with white at both ends of the joints, usually narrowly so.

The larvae are common in ground puddles in the open country. No observation of the insect biting are of record.

Distribution.—North coast of South America from the Guianas to Panama, Central America, Mexico, southern Texas.

United States Records.

Texas: San Benito, August 21, 1920 (H. G. Dyar).

Group PIPIENS.

CULEX (CULEX) QUINQUEFASCIATUS Say.

Culex quinquefasciatus Say, Journ. Acad. Nat. Sci. Phil., vol. 3, p. 10, 1823.
Culex pungens Wiedemann (not Robineau-Desvoidy), Auss. Zweifl. Ins., vol. 1, p. 9, 1828.
Culex fatigans Wiedemann, Auss. Zweifl. Ins., vol. 1, p. 9, 1828.
Anopheles ferruginosus Wiedmann, Auss. Zweifl. Ins., vol. 1, p. 12, 1828.
Culex cubensis Bigot, Hist. fisc. Ins. Cuba, vol. 7, p. 329, 1856.
Culex penafieli Williston, La Naturaleza, vol. 7, p. 326, 1887.
Culex skusii Giles, Gnats or Mosq., p. 292, 1900.
Culex quasipipiens Theobald, Mon. Culic., vol. 2, p. 136, 1901.
Culex fouchowensis Theobald, Mon. Culic., vol. 2, p. 137, 1901.
Culex osakaensis Theobald (in part), Mon. Culic., vol. 4, p. 439, 1907.
Culex christopherii Theobald, Mon. Culic., vol. 4, p. 453, 1907.
Culex aikenii Dyar and Knab, Proc. U. S. Nat. Mus., vol. 35, p, 61. 1908.
Culex lachrimans Dyar and Knab, Smith. Misc. Colls., Quart. iss., vol. 52, p. 295, 1909.
Culex revocator Dyar and Knab, Smith. Misc. Colls., Quart. iss., vol. 52, p. 256, 1909.
Culex goughii Theobald (part), Union S. Africa, Dept. Agr., 1st Rept. Vet. Res., p. 269, 1911.
Culex aseyehae Dyar and Knab, Ins. Ins. Mens., vol. 3, p. 112, 1915.

A medium-sized reddish-brown mosquito, the mesonotum with narrow curved reddish-brown scales; legs and proboscis blackish scaled, the femora pale brown at base. Abdomen blackish above, with moderate basal segmental whitish bands, separated from the lateral spots. Wing scales narrow and hairlike, wholly dark.

The male genitalia have the third plate of the mesosome pointed and straight, the second plate very long and straplike.

The larvae occur in artificial receptacles by preference, but are also found in ground pools, even far from habitations.

This is the common house mosquito of the Tropics, extending in America to about latitude 35° north and south.

Distribution.—Tropical countries throughout the world.

United States Records.

DISTRICT OF COLUMBIA: Washington, November 4, 1903 (W. V. Warner).
VIRGINIA: Alexandria, September 23, 1899 (F. C. Pratt).
SOUTH CAROLINA: Columbia, September 12, 1908 (W. H. Sligh).
GEORGIA: Myrtle, August 26, 1906 (A. A. Girault).
FLORIDA: Jacksonville, June 20, 1906 (H. Byrd).
Key West, June 7, 1903 (E. A. Schwarz).
KENTUCKY: Richmond, August 25, 1904 (H. S. Barber).
TENNESSEE: Columbia, August 16, 1904 (H. S. Barber).
MISSISSIPPI: Magnolia, July 19, 1901 (G. W. Herrick).
LOUISIANA: Baton Rouge, December 5, 1904 (E. S. G. Titus).
OHIO: Cincinnati, September 21, 1904 (T. H. C.).
ILLINOIS: Cairo, July 25, 1904 (H. S. Barber).
MISSOURI: St. Louis, May 13, 1906 (Capt. Chamberlain).
KANSAS: Lawrence, July (E. S. Tucker).
ARKANSAS: Hot Springs, October 1, 1900 (A. Wright).
TEXAS: Corpus Christi, October 20, 1905 (F. C. Pratt).
ARIZONA: Fort Yuma (E. E. Wilcox).
CALIFORNIA: Coachella, June 9, 1906 (A. N. Caudell).

CULEX (CULEX) PIPIENS Linnaeus.

Culex pipiens LINNAEUS, Syst. Nat., ed. 10, p. 602, 1758.
Culex consobrinus ROBINEAU-DESVOIDY, Mem. Soc. d'Hist. Nat. Paris, vol. 3, p. 408, 1827.
Culex flavipes MACQUART, Dipt. Exot., vol. 1, pp. 1, 35, 1838.
Culex haematophagus FICALBI, Bull. Soc. Ent. Ital., vol. 28, p. 287, 1893.
Culex pallens COQUILLETT, Proc. U. S. Nat. Mus., vol. 21, p. 303, 1898.
Culex varioannulatus THEOBALD, Mon. Culic., vol. 3, p. 198, 1903.
Culex azoriensis THEOBALD, Mon. Culic., vol. 3, p. 210, 1903.
Culex osakaensis THEOBALD (female), Mon. Culic., vol. 4, p. 439, 1907.
Culex comitatus DYAR and KNAB, Proc. Ent. Soc. Wash., vol. 11, p. 35, 1909.
Culex quasiguiarti THEOBALD (female), Mon. Culic., vol 5, p. 374, 1910.

A medium-sized reddish brown mosquito, the mesonotum with narrow curved reddish brown scales; legs and proboscis blackish scaled, the femora pale below at base. Abdomen blackish above, with moderate basal segmental whitish bands, joining the lateral spots, the band at the base of the second abdominal segment somewhat triangular. Wing scales narrow and hairlike, wholly dark.

Male genitalia with the second mesosomal plate narrow and straplike, the third oblique truncate at tip, tubelike, the lobe of the sidepiece with three rods, two setae, a filament, a leaf, and a seta.

The larvae occur in artificial receptacles by preference, but are also found in ground pools when soiled by animal refuse.

This is the common house mosquito of Europe, introduced by commerce into various temperate regions. It does not persist in the tropics. On the Pacific coast, the introduction was from Japan, with slight genitalic differences (form *pallens* Coquillett=*comitatus* Dyar and Knab).

Distribution.—Europe and Asia, from England to Japan; South America, Argentina and Chile; North America, Virginia to Canada on the Atlantic and California to British Columbia on the Pacific.

United States Records.

NEW HAMPSHIRE: Durham (H. G. Dyar).
MASSACHUSETTS: West Springfield (F. Knab).
CONNECTICUT: Fairfield, August, 1910 (V. Havard).
NEW YORK: Ithaca (O. A. Johannsen).
PENNSYLVANIA: Williamsport (H. L. Viereck).
DISTRICT OF COLUMBIA: Washington, October 20 (H. G. Dyar).
VIRGINIA: Virginia Beach, September 20, 1911 (H. G. Dyar).
ILLINOIS: Urbana (F. Knab).
OHIO: Toledo, September 13, 1915 (T. L. Ramsey).
CALIFORNIA: San Diego, December 25, 1916 (H. G. Dyar).
San Juan Capistrano, August 7, 1920 (H. G. Dyar).
Laguna Beach, July 13, 1915 (W. E. Hilton).
Roseville, August 20, 1916 (H. G. Dyar).
WASHINGTON: Vancouver Barracks (Army Medical Museum).

Group TERRITANS.

CULEX (CULEX) TERRITANS Walker.

Culex territans WALKER, Ins. Saund., Dipt., vol. 1, p. 428, 1856.
Culex restuans THEOBALD, Mon. Culic., vol. 2, p. 142, 1901.
Culex brehmei KNAB, Proc. Biol. Soc. Wash., vol. 29, p. 161, 1916.

A medium-sized reddish-brown mosquito, the proboscis and legs all dark, or the tarsi with faint pale brownish rings at the ends of the joints. Mesonotum with narrow curved bronzy brown scales, often ornamented with little patches of light yellowish ones on each side of the middle; but these light spots may be wanting. Abdomen blackish brown above, with moderate basal segmental whitish bands, transverse and even; venter whitish scaled, often with dusky angular transverse bands, the cusps directed anteriorly. Wing scales fine and hairlike, all brown.

The male genitalia have the second mesosomal plate short and pointed, without denticles. Lobe of the side piece with three rods, a seta, a leaf and a seta.

The larvae live in dirty ground puddles, and take rather readily to artificial receptacles, such as water barrels. The adults readily enter houses, thus making this the common house mosquito of northern New York and New England.

Distribution.—Eastern North America, Gulf of Mexico to Canada.

United States Records.

MAINE: Lincolnville, August, 1908 (H. G. Dyar).
NEW HAMPSHIRE: Center Harbor, August 22, 1903 (H. G. Dyar).
MASSACHUSETTS: West Springfield, June to October, 1903 (F. Knab).
NEW YORK: Tupper Lake, August, 1905 (H. G. Dyar).
NEW JERSEY: Newark, June 12, 1916 (H. H. Brehme).
MARYLAND: Plummer Island, November 2 (H. G. Dyar).
VIRGINIA: Virginia Beach, August 31, 1903 (E. A. Schwartz).
WEST VIRGINIA: Kanawha Station, August 16, 1903 (A. D. Hopkins).
NORTH CAROLINA: Black Mountains, June 2, (W. Beutenmueller).
FLORIDA: Jacksonville, March 4, 1905 (H. G. Dyar).
MISSISSIPPI: Agricultural College, June to December, 1900 (G. W. Herrick).
MINNESOTA: St. Anthony Park, July (F. L. Washburn).
IOWA: Ames, July 11, 1919 (F. C. Bishopp).
ILLINOIS: Rockford, September 3, 1917 (Lieut. Hirsch).
OHIO: New Richmond, August 5, 1907 (A. A. Girault).
MISSOURI: St. Louis, September, 1904 (A. Busck).
ARKANSAS: Little Rock, July 11, 1904 (H. S. Barber).
OKLAHOMA: Wister, August 3, 1904 (H. S. Barber).
TEXAS: Denison, June 24, 1904 (H. S. Barber).
CALIFORNIA: Little Truckee River, May 7, 1921 (H. G. Dyar).

Group SALINARIUS.

CULEX (CULEX) ERYTHROTHORAX Dyar.

Culex erythrothorax DYAR, Proc. U. S. Nat. Mus., vol. 32, p. 124, 1907.

A medium-sized reddish mosquito, the mesonotum red in the integument and with fine reddish scales, the abdomen blackish above with pale lateral basal segmental spots; venter yellowish scaled. Legs blackish scaled, the femora pale beneath. Wing scales narrow, all dark.

The scales on the mesonotum are fine and hairlike. In the male genitalia, the tenth sternites have a tuft of spines, two of them on the outer side stout and toothlike; mesosomal plate with six to eight even teeth between the upper and lower limbs.

The larvae live in long-standing or permanent ponds containing aquatic vegetation and even fish. They rest at the surface among *Lemna* in the reeds and are evidently not readily detected by the fish.

Distribution.—Southern California.

United States Records.

CALIFORNIA: San Diego, May and June, 1916 (H. G. Dyar).
San Onofre, June 27, 1906 (H. G. Dyar).
Gardena, May 30, 1906 (H. G. Dyar).
Sweetwater Junction, June 2, 1906 (Dyar and Caudell).
Guadaloupe, June 25, 1906 (A. N. Caudell).
Salinas, June 25, 1906 (H. G. Dyar).

CULEX (CULEX) SALINARIUS Coquillett.

Culex salinarius COQUILLET, Ent. News, vol. 15, p. 73, 1904.

A medium-sized brown mosquito, the mesonotum brown in the integument with fine narrow brown scales. Abdomen blackish above, with or without narrow basal segmental whitish bands, joining the lateral spots; venter yellowish. Legs blackish scaled, the femora pale beneath. Wing scales narrow, all dark.

The scales on the mesonotum are very fine and hairlike. In the male genitalia the tenth sternites have a tuft of spines, two or three of them on the outer side stout and toothlike; mesosomal plate with four or five even teeth between the large upper and lower limbs.

The larvae live in permanent pools in marshes, containing grass and *Lemna*. Frequently very abundant near the seashore, and hence named; but also occurring inland, even in water barrels on occasion.

Distribution.—United States, east of the Great Plains.

United States Records.

MASSACHUSETTS: West Springfield, August, 1903 (F. Knab).
NEW JERSEY: Seacaucus, July 27, 1921 (W. R. Bryce-Delaney).
PENNSYLVANIA: Altoona (H. L. Viereck).
MARYLAND: Chesapeake Beach, June 17 (H. G. Dyar).
DISTRICT OF COLUMBIA: Georgetown (A. N. Caudell).
VIRGINIA: Arlington, August 28, 1917 (H. G. Dyar).
NORTH CAROLINA: Wilmington, July 22, 1918 (W. R. Leiby).
GEORGIA: Savannah, June 23, 1920 (V. H. Bassett).
FLORIDA: Jacksonville (Army Medical Museum).
LOUISIANA: Baton Rouge (H. A. Morgan).
MISSOURI: St. Louis, September, 1904 (A. Busck).
KENTUCKY: Corbin, August 24, 1904 (H. S. Barber).
ILLINOIS: Cairo, July 25, 1904 (H. S. Barber).
IOWA: Ames, August 14, 1906 (H. J. Quayle).
ARKANSAS: Little Rock (Army Medical Museum).

CULEX (CULEX) SIMILIS Theobald.

Culex similis THEOBALD, Mon. Culic., vol. 3, p. 207, 1903.
Culex microsquamosus GRABHAM, Can. Ent., vol. 37, p. 407, 1905.
Culex carmodyae DYAR and KNAB, Journ. N. Y. Ent. Soc., vol. 14, p. 210, 1906.
Culex regulator DYAR and KNAB, Journ. N. Y. Ent. Soc., vol. 14, p. 213, 1906.
Culex prasinopleurus MARTINI, Ins. Ins. Mens., vol. 20, p. 68, 1914.

A medium-sized, blackish mosquito, the mesonotum dark brown with fine, narrow, blackish scales. Abdomen black above, with or without narrow segmental basal whitish bands, joining the lateral spots; venter whitish scaled, with diffuse black bands at the apices of the segments. Legs black, the femora whitish beneath, tips of tibiae white. Wing scales narrow, all dark.

The scales on the mesonotum are very fine and hairlike, giving a velvety appearance. The tenth sternites of the male genitalia have a tuft of spines, the outer three or six of them stout and toothlike; mesosomal plate with two or more even teeth and a small one between the upper and lower limbs, the tooth from the base very long, with radial pecten between its base and the margin.

The larvae live in permanent pools in swamps and holes in coral rock, usually without vegetation, sometimes occurring in clear wells.

Distribution.—Greater Antilles and southern Florida. The species is considered a race of the earlier described *Culex nigripalpus* Theobald,[6] which inhabits the tropical mainland from Trinidad to Panama and Central America.

United States Records.

FLORIDA: Miami, October 29, 1921 (G. F. Moznette).
Pokatee, March 19, 1905 (A. N. Caudell).
Green Cove Springs, 1905 (A. N. Caudell).
Jacksonville, March 4, 1905 (H. G. Dyar).

Group TARSALIS.

CULEX (CULEX) TARSALIS Coquillett.

Culex tarsalis COQUILLETT, Can. Ent., vol. 28, p. 43, 1896.
Culex willistoni GILES, Handb. Gnats or Mosq., p. 281, 1900.
Culex affinis ADAMS, Kans. Univ. Bull, vol. 20, p. 25, 1903.
Culex kelloggii THEOBALD, Can. Ent., vol. 25, p. 211, 1903.
Culex peus SPEISER, Insektenbörse, vol. 21, p. 148, 1904.

A medium-sized mosquito, the mesonotum bronzy-brown scaled, frequently ornamented with narrow silvery-white lines each side of the posterior portion, running back to the scutellum. The abdomen is blackish or brown, with moderate basal segmental white bands, the one on the basal segment triangular; venter whitish scaled, with angular transverse black bands, which form cusps directed posteriorly. Proboscis dark, with a white ring near the middle. Legs brown, the femora white beneath, the tarsi with white rings at both ends of the joints, small on front and middle legs, distinct on the hind pair, a white line on the outer side of femora and tibiae. Wing scales wholly dark, fine and hairlike, forming a little tuft at the base of the third vein.

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[6] See Dyar, Ins. Ins. Mens., vol. 9, p. 28, 1921, for the synonymy.

The male genitalia have the mesosomal plate large and furnished with denticles between the arms, the outer arm serrate. The lobe of the sidepiece has three rods, a seta, a leaf, and a seta. The tenth sternites have all the spines long and alike.

The larvae are commonly found in grassy ponds or marshes, often in escaping irrigation water. They do not take to artificial receptacles.

This mosquito will enter houses and may become a considerable nuisance in the western part of the country.

Distribution.—Mississippi Valley and western prairies to the Pacific Ocean, Mexico to British Columbia.

United States Records.

WASHINGTON: Bellingham, May 31, 1917 (H. G. Dyar).
Oroville, July 28, 1920 (H. G. Dyar).
OREGON: Portland (R. P. Currie).
Hood River, July 9, 1917 (F. R. Cole).
CALIFORNIA: San Diego, April 14, 1906 (J. M. French).
Stanford University, 1901 (I. MacCracken).
Kelly Hot Springs, June 15, 1916 (W. B. Herms).
IDAHO: Boise, August 14, 1901 (C. B. Simpson).
NEVADA: Reno, November 5, 1915 (H. G. Dyar).
ARIZONA: Carr, August, 1905 (H. Skinner).
NEW MEXICO: Springer, August, 1909 (C. N. Ainslie).
COLORADO: Boulder, October 15 (T. D. A. Cockerell).
KANSAS: Lawrence, June (E. S. Tucker).
IOWA: Ames, October 18, 1905 (H. J. Quayle).
ILLINOIS: Urbana, September 10, 1904 (A. Busck).
MISSOURI: St. Louis, September, 1904 (A. Busck).
TEXAS: Dallas, May 11, 1905 (W. D. Pierce).
Devils River, May 6, 1907 (F. C. Pratt).

CULEX (CULEX) THRIAMBUS Dyar.

Culex (*Culex*) *thriambus* DYAR, Ins. Ins. Mens., vol. 9, p. 33, 1921.

A medium-sized brown mosquito, the mesonotum bronzy brown. Abdomen blackish, with basal segmental white bands, widened in the middle; venter pale, with angular black marks on the posterior borders of the segments, the cusps directed forward. Proboscis broadly whitish below, ringed with white in the male and sometimes also in the female. Legs black, the femora and tibiae pale below, tarsi ringed with white on both ends of the joints, rather broadly so on the hind legs. Wing scales narrow and dark.

The genitalia do not differ markedly from those of *tarsalis* and *stigmatosoma*. The species is close to *stigmatosoma* and may be an eastern race of it. The larvae have the hairs on the air tube single, whereas they are multiple in *stigmatosoma*.

Only one occurrence of this form is yet of record, larvae in pools in the bed of a river which had recently been filled by a freshet from rains.

Distribution.—Central Texas.

United States Records.

TEXAS: Kerrville, August 20, 1920 (H. G. Dyar).

CULEX (CULEX) STIGMATOSOMA Dyar.

Culex stigmatosoma DYAR, Proc. U. S. Nat. Mus., vol. 32, p. 123, 1907.
Culex eumimetes DYAR and KNAB, Proc. U. S. Nat. Mus., vol. 35, p. 61, 1908.

A medium-sized or rather large brown mosquito, the mesonotum dark brown with more or less of ornamentation of posterior silvery lines. Abdomen blackish, with basal segmental white bands, widened in the middle; venter pale, with a round black spot posteriorly on each segment, more or less developed. Legs black, the femora pale beneath, the tarsi ringed with white on both ends of the joints, narrowly so on the front and mid legs, broadly so on the hind. No white line on the outside of femora or tibiae, though these parts may be whitish beneath. Wing scales narrow, black.

The male genitalia are not different enough from those of *tarsalis* to be diagnostic.

The larvae inhabit pools left in the beds of streams when these have gone dry after the seasonal rains in the arid country. They may occur also in pools of artificial formation in the same region, even fountains or water troughs for horses.

Distribution.—The arid west coastal region from Central America and Mexico to Oregon.

United States Records

CALIFORNIA: San Diego, May, 1916 (H. G. Dyar).
San Luis Obispo, June, 1906 (A. N. Caudell).
Chico, June, 1906 (A. N. Caudell).
OREGON: Klamath Falls, July, 1906 (Dyar and Caudell).

Group CORNIGER.

CULEX (CULEX) CORNIGER Theobald.

Culex corniger THEOBALD, Mon. Culic., vol. 3, p. 173, 1903.
Culex lactator DYAR and KNAB, Journ. N. Y. Ent. Soc., vol. 14, p. 205, 1906.
Culex hassardii GRABHAM, Can. Ent., vol. 38, p. 167, 1906.
Culex basilicus DYAR and KNAB, Proc. Biol. Soc. Wash., vol. 19, p. 169, 1906.
Culex lactator loquaculus DYAR and KNAB, Smith. Misc. Colls., Quart. iss., vol. 52, p. 254, 1909.
Culex leucotelus MCCORMACK, Panama Health Rep., 1918, p. 29, 1919.

A medium-sized blackish mosquito, the mesonotum with dark brown scales in the middle, generally conspicuously ornamented with gray scales around the margins and a pair of dots in the middle. Abdomen black dorsally, banded or with a row of small segmental spots or none, lateral basal white spots, the venter pale, banded with black on the posterior borders of the segments. Proboscis with a white ring in both sexes. Tarsi ringed with white at both ends of the joints, narrowly so, even on the hind legs. Wing scales fine, all dark.

The larvae occur in ground pools, by preference dirty ones, also in containers even of small size, having been taken in coconut husks and bamboo joints. The water in these is especially foul. The larvae are readily recognized by the peculiar short air tube, suggesting that of an *Aëdes*.

Distribution.—Tropical America, Mexico, Central America, Ecuador, the Guianas, Antilles and Florida Keys.

United States Records.

Florida; Knight's Key, December 2, 1908 (W. H. Sligh).

Subgenus CLIMACURA Howard, Dyar, and Knab.

CULEX (CLIMACURA) MELANURUS Coquillett.

Culex melanurus COQUILLETT, Journ. N. Y. Ent. Soc., vol. 10, p. 193, 1902.

A dark-brown mosquito, rather over middle size, the abdomen wholly blackish above, without white bands. Proboscis and legs blackish, the femora narrowly whitish beneath. Mesonotum with dark brown scales and conspicuous dark setae. The abdomen has pale triangular basal segmental spots on the sides, the venter pale, with faint darker bands at the apices of the segments. The wing scales are long, dense, and broader than usual, being ligulate, rather than hairlike, all dark brown.

The male genitalia have the mesosome membranous and paired, with an outwardly directed basal chitinization. Sidepiece without lobe, the basal excavation with three stout setae at its tip.

The larvae live in small collections of permanent water in swamps, and are very peculiar in passing the winter as full-grown larvae under the ice. The eggs appear to be laid singly on the surface of water in the summer time. No observations are on record of the biting habits of the adult. The mosquito is rare, and in no way troublesome.

Distribution.—Gulf of Mexico and Atlantic watershed to northern New York and New Hampshire, presumably in southern Canada.

United States Records.

NEW HAMPSHIRE: Center Harbor, August 19, 1902 (H. G. Dyar).
MASSACHUSETTS: Westfield, August, 1903 (F. Knab).
NEW YORK: Tupper Lake, August 11, 1905 (H. G. Dyar).

NEW JERSEY: Lahaway, March 27 (J. T. Brakeley).
VIRGINIA: Alexandria, September 22, 1899 (F. C. Pratt).
Lake Drummond, October 29, 1906 (H. S. Barber).
SOUTH CAROLINA: Hartsville, June 24, 1914 (J. A. LePrince).
GEORGIA: Augusta, August 10, 1909 (W. V. Reed).
ARKANSAS: Scott, April 16, 1914 (J. K. Thibault).

Genus CULISETA Felt.[1]

Theobaldia NEVEU-LEMAIRE, C. R. Soc. Biol., vol. 54, p. 1331, 1902.
Culiseta FELT, Bull. 79, N. Y. Sta. Mus., p. 391c, 1904.
Theobaldinella BLANCHARD, Les Moust., p. 390, 1905.
Pseudotheobaldia THEOBALD, Mon. Culic., vol. 4, p. 150, 1907.
Allotheobaldia BROLEMANN, Ann. Soc. Ent. France, vol. 88, p. 90, 1919.

The species of *Culiseta* are large mosquitoes, inhabiting temperate latitudes in both Europe and America. The genus contains but a small number of species. The larvae inhabit permanent water, the eggs of *Culiseta* proper being deposited in rafts by overwintering females. Some of the species take kindly to artificial containers, but the adults rarely attack man, preferring larger mammals such as horses and cattle.

Two subgenera may be recognized on the characters of the male genitalia, as follows:

1. Unci divided into two outwardly directed plates ---- Subgenus **Culicella** Felt.
Unci undivided ---- Subgenus **Culiseta** Felt.

KEY TO THE UNITED STATES SPECIES OF CULISETA.

1. Tarsi with faint whitish rings at both ends of the joints; wings narrow as in *Culex* ---- **dyari** Coquillett.
Tarsal rings if present basal; wings broader ---- 2
2. Tarsi with broad white rings at the bases of some of the joints; wings spotted ---- 3
Tarsi with very narrow white rings; wings spotted ---- **incidens** Thomson.
Tarsi without white rings; wings sunspotted ---- 4
3. Mid and hind femora with white rings ---- **maccrackenae** Dyar and Knab.
Femora without white rings ---- **alaskaensis** Ludlow.
4. Wing scales narrow, hairlike; no scales on the cross veins ---- **impatiens** Walker.
Wing scales broader; scales sometimes present on the cross veins. **inornatus** Williston.

Subgenus CULICELLA Felt.

CULISETA (CULICELLA) DYARI Coquillett.

Culex dyari COQUILLETT, Journ. N. Y. Ent. Soc., vol. 10, p. 192, 1902.
Culex brittoni FELT, Ent. News, vol. 16, p. 79, 1905.

A rather large dark-brown mosquito. Mesonotum with two bare impressed light brown lines, the vesiture sparse, forming frosted lines, mixed with setae. Abdomen with rather broad whitish bands

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[1] *Theobaldia* of European writers.

at the bases of the segments. Legs dark brown, with obscure, narrow pale rings, involving both ends of the tarsal joints; venter pale sordid, with dark bands at the apices of the segments. Proboscis entirely blackish.

The male genitalia have the mesosome divided into two plates.

The larvae are found in spring in cold bogs, apparently developing from overwintering eggs, but nothing certain is known about the habits of the species. No observations of its biting are on record. The males are attracted rather freely to light.

Distribution.—Northern forests, in cold bogs southward to New Jersey.

United States Records.

NEW HAMPSHIRE: Center Harbor, May, 1902 (H. G. Dyar).
Dublin (A. Busck).
MASSACHUSETTS: Wilmington, July, 1910 (H. S. Barber).
Springfield, May, 1903 (F. Knab).
CONNECTICUT: Suffield, May 12, 1903 (F. Knab).
NEW YORK: Tupper Lake, August 16, 1905 (H. G. Dyar).
McLean, July 9, 1910 (B. K. Miller).
NEW JERSEY: Culvers Lake, May 29, 1908 (J. B. Smith).
WISCONSIN: Saxeville, May, 1910 (B. K. Miller).

Subgenus CULISETA Felt.

CULISETA (CULISETA) ALASKAËNSIS Ludlow.

Theobaldia alaskaënsis LUDLOW, Can. Ent., vol. 38, p. 326, 1906.
Culiseta siberiensis LUDLOW, Ins. Ins. Mens., vol. 7, p. 151, 1919.
Theobaldia arctica EDWARDS, Bull. Ent. Res., vol. 10, p. 136, 1920.

A very large blackish mosquito. Proboscis dark brown, palpi with small white tips at the ends of the joints. Mesonotum uniformly colored, without impressed lines, the vestiture of black and white narrow curved scales, appearing coarsely frosted. Abdomen black, with basal segmental white bands, the venter mostly whitish scaled. Legs black mixed with some white scales, femora whitish beneath, femora and tibiae with a white line on the outer side; tarsi with white rings at the bases of the joints, mostly small; but large on the second and third joints of the hind legs. Wings broad, the cross veins in line; scales black, mixed with some white ones along costa, forming tufts or spots at the bases of first, third, and fourth veins and the forks of second, fourth, and fifth.

The male genitalia have the aedoeagus simple, the penultimate segment without spines.

The larvae live in grassy marshes, generally in river valleys. The adults pass the winter hiding in hollow logs and similar locations, and appear very early in the spring. The eggs are deposited in rafts on the surface of the water. The adults will attack man, but are never numerous or particularly troublesome.

Distribution.—Northern Europe and America; Scotland; Siberia; Alaska, to the Yukon Valley.

United States Records.

ALASKA: Koyukuk River, "summer" 1901 (W. J. Peters).
Eagle, June 2, 1906 (Army Medical Museum).
Unalakleet, May 29, 1921 (S. Hadwen).
Beaver Mountains, May 26, 1917 (A. K. Twitchell).
Kevalina, July 31, 1921 (S. Hadwen).

CULISETA (CULISETA) MACCRACKENAE Dyar and Knab.

Culiseta maccrackenae DYAR and KNAB, Proc. Biol. Soc. Wash., vol. 19, p. 133, 1906.

A large dark mosquito with conspicuously spotted wings; mesonotum dark brown, frosted with white, with two narrow white lines posteriorly. Abdomen black above, with narrow white bands at the bases of the segments; venter yellowish white with scattered black scales. Legs blackish, the mid and hind femora with white rings, the tarsi with broad white rings at the bases of the second to fourth joints. Wing broad, the membrane infuscated, forming brown spots at origin of second vein, end of cell and bases of forks, the scales narrow, dark, existing also on the cross veins.

The larvae inhabit pools in stream beds in late spring or early summer after the streams have become sluggish, the pools containing much aquatic vegetation. The larva, however, has not been described. The species is remarkably rare.

Distribution.—Coastal region of California.

United States Records.

CALIFORNIA: Eureka, June 3 (H. S. Barber).
Presidio, San Francisco, July 4, 1906 (Army Medical Museum).
Stanford University, March, June, 1903 (I. MacCracken).
Bakersfield, May 27, 1918 (H. E. Woodworth).

CULISETA (CULISETA) INCIDENS Thomson.

Culex incidens THOMSON, Kongl. Sven. Freg. Eug. Resa, pt. 6, Dipt., p. 443, 1868.

Culex particeps ADAMS, Kans. Univ. Sci. Bull., ser. 2, vol. 2, p. 26, 1903.

A large dark mosquito with spotted wings. Mesonotum uniform, without impressed lines; vestiture dark, mixed with yellowish white scales, which form diffuse longitudinal lines, and a spot on each side. Abdomen black, with basal segmental white bands; venter whitish scaled. Legs black, the femora whitish below, the tibiae also more or less whitish within; tarsi with white specks at the bases of the joints, a rather distinct ring at the base of the second hind tarsal. Wings broad, the cross veins in line, or nearly so; wing scales black, hairlike, forming more or less conspicuous spots on the bases of the forks of the second and fourth veins, and along the second and fourth veins within the cross veins.

The male genitalia have the aedoeagus simple; a short row of spines on the penultimate segment.

The larvae live in permanent pools of a dirty character, and take readily to artificial receptacles, this being the common water-barrel mosquito of the West. The adults hibernate; the eggs are laid in narrow rafts on the surface of water. The adults will attack man, but rarely, preferring larger mammals. A man on horseback is generally immune, though the horse may be bitten.

Distribution.—Northern Rocky Mountains and the Pacific coast from southern California to Alaska.

United States Records.

New Mexico: Las Vegas Hot Springs, August 12 (H. S. Barber).
Santa Fe, July (T. D. A. Cockerell).
Arizona: Grand Canyon, May, 1906 (H. G. Dyar).
California: San Diego, February 3, 1906 (J. M. French).
Los Angeles, June 10, 1906 (H. G. Dyar).
Stanford University, October 11, 1900 (I. MacCracken).
Lake Tahoe, June 8, 1916 (H. G. Dyar).
Dunsmuir (A. N. Caudell).
Nevada: Reno, August 18, 1915 (H. G. Dyar).
Glenbrook, August 29, 1915 (H. G. Dyar).
Oregon: Portland (R. P. Currie).
Forest Grove, August 31, 1920 (Edna Bond).
Hood River, July 22, 1917 (F. R. Cole).
Washington: Bellingham, May 31, 1917 (H. G. Dyar).
Ashford, June 18, 1917 (H. G. Dyar).
Lake Cushman, July 4, 1920 (H. G. Dyar).
Montana: Big Fork (E. Ricker).
Alaska: Cape Fanshaw, June 26, 1919 (H. G. Dyar).

CULISETA (CULISETA) IMPATIENS Walker.

Culex impatiens Walker, List Dipt. Brit. Mus., vol. 1, p. 5, 1848.
Culex pinguis Walker, Lord's Nat. in Vanc. Is. & B. C., vol. 2, p. 337, 1866.
Culex absobrinus Felt, Bull. 79, N. Y. State Mus., p. 391c, 1904.

A very large dark-brown mosquito. Proboscic and palpi black. Mesonotum with two broad impressed lighter brown lines, the vestiture sparse, and forming frosted yellowish lines on each side posteriorly. Abdomen black, with basal segmental white bands; venter mostly whitish. Legs black, the femora white beneath; knee spots pale. Wings broad, the cross veins nearly in line, the scales all blackish, coarsely linear; a small tuft at base of third vein, but no scales on the cross veins.

The male genitalia have the aedoeagus simple; a long row of spines on the penultimate segment.

The larvae live in dark permanent pools in the forest, where they are frequently much preyed upon by *Eucorethra underwoodi* larvae. The adults hibernate; the eggs are deposited in broad roundly triangular rafts on the surface of the water.

Distribution.—Northern forests from the Atlantic to Pacific, mountains of California to Alaska.

United States Records.

MAINE: Weld, August, 1910 (H. G. Dyar).
NEW HAMPSHIRE: Monadnock, May 11, 1911 (A. H. Thayer).
NEW YORK: Elizabethtown, April 25, 1905 (H. G. Dyar).
Tupper Lake (H. G. Dyar).
MONTANA: Glacier Park, July 1, 1921 (H. G. Dyar).
WASHINGTON: Glacier, June 4, 1917 (H. G. Dyar).
Lake Cushman, June 27, 1917 (H. G. Dyar).
Longmire Springs, June 14, 1917 (H. G. Dyar).
OREGON: Crater Lake, July 29, 1920 (H. G. Dyar).
CALIFORNIA: Lake Tahoe, June 5, 1916 (H. G. Dyar).
ALASKA: Iditarod, June 12, 1918 (A. K. Twitchell).
Yakutat, June 21, 1899 (T. Kincaid).
Dead Horse, June 18, 1921 (J. M. Aldrich).
Anchorage, July 19, 1921 (J. M. Aldrich).
Sitka, June 16, 1899 (T. Kincaid).
Skagway, August 4, 1919 (H. G. Dyar).
Cape Fanshaw, June 22, 1919 (H. G. Dyar).

CULISETA (CULISETA) INORNATUS Williston.

Culex inornatus WILLISTON, U. S. Dept. Agr., Div. Orn. & Mam., N. Am. Fauna No. 7, p. 253, 1893.
Culex magnipennis FELT, Bull. 79, N. Y. State Mus., p. 278, 1904.

A very large brown mosquito. Proboscis and palpi brown. Mesonotum with two pale brown, slightly impressed lines, the vestiture crossing these, of pale yellowish and dark scales mixed. Abdomen dark brown, with diffused pale yellow basal segmental bands, and scattering scales over the rest; venter sparsely pale yellow scaled. Legs dark brown, with scattered pale scales, the femora and tibiae pale below; tarsi nearly black. Wings broad, the cross veins somewhat approximated, but not very close, long from the breadth of the wing and generally with a few scales; wing scales linear, all dark, not forming any spots.

The male genitalia have the aedoeagus slender and crested; penultimate segment without spines.

The larvae live in permanent ground pools. They do not come in artificial receptacles. The adults hibernate, and the eggs are laid in elongate rafts on the surface of water. The adult is not troublesome, probably attacking by preference the larger mammals.

Distribution.—North America, from Mexico to southern Canada, exclusive of the northern forests.

United States Records.

NEW YORK: (E. P. Felt).
MASSACHUSETTS: Beverly, September 28, 1870 (G. Dimmock).
DISTRICT OF COLUMBIA: Washington, April 23, 1903 (W. V. Warner).
NORTH CAROLINA: Wilmington, March 7, 1919 (M. Kisliuk, Jr.).
SOUTH CAROLINA: Charlestown, April, 1913 (R. L. Watson).
FLORIDA: Jacksonville, March 4, 1905 (H. G. Dyar).
ALABAMA: Mobile, March, 1905 (G. Dimmock).
MISSISSIPPI: Agricultural College, April 12, 1903 (G. W. Herrick).
LOUISIANA: Baton Rouge, November, 1902 (J. W. Dupree).
TEXAS: Dallas, November 10, 1905 (W. E. Hinds).
ARKANSAS: Hot Springs, November 26, 1900 (J. J. Curry).
KANSAS: Lawrence, (J. M. Aldrich).
MISSOURI: St. Louis, July, 1904 (A. Busck).
ILLINOIS: Urbana, September 29, 1904 (F. Knab).
WISCONSIN: Madison (S. J. Holmes).
SOUTH DAKOTA: Brookings, (J. M. Aldrich).
Mitchell, October, 1902 (E. L. Fullmer).
Dillon, October, 1902 (R. A. Cooley).
MONTANA: Lake View, August 2, 1920 (A. N. Caudell).
IDAHO: Boise, August 1 (C. B. Simpson).
UTAH: Garfield, April 10, 1920 (H. G. Dyar).
NEVADA: Reno, July 19, 1915 (H. G. Dyar).
OREGON: Klamath Falls, (Dyar and Caudell).
CALIFORNIA: Eureka, (A. N. Caudell).
Los Angeles, (D. W. Coquillett).
San José, May 13, 1906 (———).
ARIZONA: Williams, May 25 (H. S. Barber).
NEW MEXICO: Santa Fé, July (T. D. A. Cockerell).
COLORADO: Boulder, September (T. D. A. Cockerell).

Genus MANSONIA Blanchard.[8]

Taeniorhynchus LYNCH ARRIBALZAGA (part, misidentified), Rev. Mus. de La Plata, vol. 1, p. 374, 1891.
Panoplites THEOBALD (not Gould), Mon. Culic., vol. 2, p. 173, 1901.
Mansonia BLANCHARD, C. R. Soc. de Biol., vol. 53, p. 1045, 1901.
Coquillettidia DYAR, Proc. Ent. Soc. Wash., vol. 7, p. 45, 1905.
Mansonioides THEOBALD, Mon. Culic., vol. 4, p. 498, 1907.
Rhynchotaenia BRÈTHES, Anal. Mus. Nac. B. A., ser. 3, vol. 13, p. 470, 1911.
Pseudotaeniorhynchus THEOBALD, Nov. Cul., vol. 1, p. 19, 1911.

A small genus of general distribution, the species more numerous in the Tropics. The larvae are peculiar in having the air tube adapted for piercing the vascular roots of certain aquatic plants, from which they get their supply of air. The eggs are deposited in rafts in swamps where suitable plants grow, and the young larvae descend to the roots, never coming to the surface again.

The genus has been divided into subgenera on genitalic characters,[9] as follows:

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[8] *Taeniorhynchus* of European authors.
[9] Dyar, Ins. Ins. Mens., vol. 6, p. 112, 1918.

1. Clasper branched; process from the angle of excavation of sidepiece long, swollen at tip, with short inserted rod……Subgenus **Mansonia** Blanchard.
   Clasper simple; process short, at least shorter than the rod, not swollen at tip. Subgenus **Coquillettidia** Dyar.

KEY TO THE UNITED STATES SPECIES OF MANSONIA.

1. Hind tibia with a white ring beyond the middle……**perturbans** Walker.
   Hind tibia without a white ring……**titillans** Walker.

Subgenus COQUILLETTIDIA Dyar.

MANSONIA (COQUILLETTIDIA) PERTURBANS Walker.

Culex perturbans WALKER, Ins. Saund., Dipt., p. 428, 1856.
Culex ochropus DYAR and KNAB, Journ. N. Y. Ent. Soc., vol. 15, p. 100, 1907.

A rather large mosquito with scaly wings and conspicuously ringed legs. Proboscis with many pale scales in the middle, the base and tip dark. Mesonotum with rather coarse pale golden scales, imperfectly covering the surface. Abdomen brown, with a few pale scales at the bases of the segments and triangular whitish spots at the sides; venter pale scaled, with blackish ones toward the apices of the segments. Legs dark, with pale scales intermixed, the femora and tibiae pale beneath, the hind tibia with a pale ring at outer third; tarsi with broad white rings at the bases of the joints, the first joint also with a white ring in the middle. Wings with the scales dense and rather broad, brown with white ones intermixed.

The larvae are attached to the roots of a species of *Carex* growing in marshes or the edges of ponds. The winter is passed as half-grown larva. The adults fly several miles from the breeding grounds and are severe biters. They have been known to descend unused chimneys to get into dwellings which were otherwise screened.

Distribution.—North America, Florida to Canada, westward in timbered country to British Columbia.

United States Records.

MAINE: Lincolnville, August, 1908 (H. G. Dyar).
NEW HAMPSHIRE: Center Harbor, August, 1902 (H. G. Dyar).
MASSACHUSETTS: Springfield, June 7, 1903 (F. Knab).
CONNECTICUT: Brandford, June 4, 1904 (H. L. Viereck).
NEW YORK: Ithaca, July 14 1891 (J. H. Comstock).
NEW JERSEY: Delair, July 9, 1901 (W. P. Seal).
MARYLAND: Lakeland, August 8, 1895 (F. C. Pratt).
DISTRICT OF COLUMBIA: Washington, August, 1906 (T. Pergande).
VIRGINIA: Lake Drummond, June 11, 1905 (H. S. Barber).
NORTH CAROLINA: Plymouth, June 8, 1910 (N. C. Dept. Agriculture).
GEORGIA: Myrtle, May 19, 1906 (A. A. Girault).
FLORIDA: Lake Okeechobee, March, 1906 (J. H. Egbert).
LOUISIANA: New Orleans, May 2, 1901 (H. A. Veazie).
ARKANSAS: Little Rock, July 11, 1904 (H. S. Barber).
MISSOURI: St. Louis, August, 1904 (A. Busck).

Iowa: Ames, June 27, 1906 (H. J. Quayle).
Wisconsin: Saxeville, July 2, 1909 (B. K. Miller).
Ohio: Toledo, July 6, 1915 (C. Fox).
Indiana: Lake Maxinkuckee (W. B. Evermann).
Montana: Big Fork, July 25, 1903 (E. Ricker).

Subgenus MANSONIA Blanchard.

MANSONIA (MANSONIA) TITILLANS Walker.

Culex titillans Walker, Cat. Brit. Mus., Dipt., vol. 7, p. 5, 1848.

A medium-sized dark-brown mosquito. Mesonotum with sparse golden scales, the integument showing, giving a frosty appearance. Abdomen black above, with scattered white scales, the basal segment yellowish; venter yellowish gray. Wing scales broad and dense, black and yellowish, peppered. Legs blackish brown, with scattered light scales on femora and tibiae, the tarsi with white rings at the bases of the joints, moderately broad on the hind legs. The proboscis has a small while ring beyond the middle. The palpi in the female are nearly half as long as the proboscis. In the male they exceed it by about the length of the last joint.

The larvae are attached to the roots of a floating water plant known as "water hyacinth" or *Pistia.* These plants occur in great profusion in lakes or still rivers, and the mosquitoes may become very abundant in such places. They are said to be fierce in attack, and the bites painful.

Distribution.—Tropical America from Brazil to Mexico, the Antilles, the Everglades of Florida.

United States Records.

Florida: Lake Okeechobee, March, 1906 (J. H. Egbert).

Genus PSOROPHORA Robineau-Desvoidy.

Psorophora Robineau-Desvoidy, Mem. Soc. Hist. Nat. Paris, vol. 3, p. 412, 1827.
Janthinosoma Lynch Arribalzaga, Rev. Mus. de La Plata, vol. 1, p. 374, 1891.
Grabhamia Theobald, Mon. Culic., vol. 3, p. 243, 1903.
Conchyliastes Howard, Mosq., p. 155, 1901.
Feltidia Dyar, Proc. Ent. Soc. Wash., vol. 7, p. 45, 1905.
Ceratocystia Dyar and Knab, Journ. N. Y. Ent. Soc., vol. 14, p. 178, 1906.
Lepidosia Coquillett, Science, n. s., vol. 23, p. 314, 1906.

A genus of tropical American origin, developed as an extreme specialization of the *Aëdes* type. The species are large and showy. The larvae develop in transient rain pools with great rapidity, from egg to adult in four or five days under favorable conditions. The eggs are spinose to withstand desiccation, and remain on the dry ground for long periods awaiting rain. How long the eggs may lie and remain living is not known, but periods of three or four years seem certain.

A number of the species have predaceous larvae, feeding exclusively upon other mosquito larvae that are in the pools with them. Most of these are naturally other *Psorophora*, but some of the rapidly developing *Aëdes* also fall victims.

The genus has been subdivided on the characters of the male genitalia. In addition to these we will use the claws of the female, as follows:

1. Claws of the female simple ---------- Subgenus **Grabhamia** Theobald.
   Claws of the female toothed ---------- 2.
2. Male claspette with setae evenly over the bulbous tip. Subgenus **Psorophora** Robineau-Desvoidy.
   Male claspette with all the setae on the inner aspect, in one species soldered to the side piece ---------- Subgenus **Janthinosoma** Lynch Arribalzaga.

KEY TO THE UNITED STATES SPECIES OF PSOROPHORA.

1. Claws of the female toothed ---------- 2.
   Claws of the female simple ---------- 8.
2. Mesonotum with smooth nude areas ---------- 3.
   Mesonotum entirely scaled ---------- 5.
3. Mesonotum with median stripe of golden scales ---------- 4.
   Mesonotum without such stripe ---------- **howardii** Coquillett.
4. Legs with many outstanding scales ---------- **ciliata** Fabricius.
   Legs smooth, without outstanding scales ---------- **ctites** Dyar.
5. Hind legs with raised, outstanding scales ---------- 6.
   Hind legs smooth, without outstanding scales ---------- 7.
6. Thorax without median dark stripe ---------- **sayi** Dyar and Knab.
   Thorax with median dark stripe ---------- **horridus** Dyar and Knab.
7. Penultimate joint of hind tarsi white ---------- **discrucians** Walker.
   Tarsi without white ---------- **cyanescens** Coquillett.
8. Yellowish species with spotted wings ---------- 9.
   Blackish species with peppered wings ---------- 10.
9. Costa pale with two black spots beyond the middle ---------- **signipennis** Coquillett.
   Wing not so marked ---------- **discolor** Coquillett.
10. First hind tarsal joint with a middle white ring ---------- **columbiae** Dyar and Knab.
    This joint without a white ring ---------- **pygmaea** Theobald.

Subgenus PSOROPHORA Robineau-Desvoidy.

PSOROPHORA (PSOROPHORA) CILIATA Fabricius.

Culex ciliata FABRICIUS, Ent. Syst., vol. 4, p. 401, 1794.
Culex molestus WIEDEMANN, Dipt. Exot., p. 7, 1821.
Culex rubidus ROBINEAU-DESVOIDY, Mem. Soc. Nat. Hist. Paris, vol. 3, p. 404, 1827.
Psorophora boscii ROBINEAU-DESVOIDY, Mem. Soc. Nat. Hist. Paris, vol. 3, p. 413, 1827.
Culex conterrens WALKER, Ins. Saund., Dipt., p. 427, 1856.

A very large mosquito, with dusky wings and shaggy, white-ringed legs. Scales on palpi and base of proboscis mostly shaggy and erect, dark. Mesonotum with smooth nude areas, a line of golden scales in the middle, and large patch of silvery gray ones on the shoulders. Abdomen brown scaled, with scattering white ones especially toward the tips of the segments. Legs with the yellow integument showing in many places; black erect scales at ends of femora, all of tibiae and apices of tarsal joints, the tarsi, especially the hind pair, broadly white ringed at the bases. Wings with narrow brown scales, mixed with some whitish ones along the costa.

The larvae live in temporary rain puddles, and are predaceous upon the larvae of other mosquitoes with the same habit, either *Psorophora* (subgenus *Grabhamia*) or *Aëdes*. The period of larval life is very short. The winter is passed in the egg state, the eggs being spinose and adapted to withstanding desiccation. The adult is a severe biter; but may be classed otherwise as a beneficial insect, since its larva destroys many other mosquito larvae.

Distribution.—Northern Mexico to the eastern United States east of the plains to northern New York.

United States Records.

Massachusetts: Springfield, September 20, 1903 (F. Knab).
Connecticut: Suffield, August 24, 1874 (G. Dimmock).
New York: Valcour Island, Lake Champlain (G. H. Hudson).
New Jersey: Delair, September 27, 1900 (W. P. Seal).
Maryland: Baltimore, July, 1899 (D. C. Clark).
District of Columbia: Washington, July 28, 1906 (H. S. Barber).
Virginia: Grassymead, June 20, 1904 (H. G. Dyar).
West Virginia: Kanawha Station, July 20, 1907 (A. D. Hopkins).
North Carolina: Sullivan Island. August 31, 1903 (W. H. Parker).
South Carolina: McClellanville, October 12, 1906 (____).
Georgia: Savannah, September 1, 1920 (V. H. Bassett).
Florida: Key West, August, 1901 (A. Busck).
Miami, November 1, 1921 (G. F. Moznette).
Mississippi: Agricultural College, July 10, 1902 (G. W. Herrick).
Louisiana: Johnson's Bayou, July 26, 1906 (J. D. Mitchell).
Arkansas: Deckerville, October 5, 1900 (W. B. Burns).
Texas: Brownsville. May 26, 1904 (H. S. Barber).
Indian Territory: Wister, July 5, 1904 (H. S. Barber).
Kansas: Manhattan, August 24, 1906 (R. E. Eastman).
Nebraska: Lincoln, August (L. Bruner).
Iowa: Burlington (P. Bartsch).
Michigan: Agricultural College, September 8, 1896 (R. H. Pettit).
Indiana: Winona Lake (E. B. Williamson).

PSOROPHORA (PSOROPHORA) CTITES Dyar.

Psorophora ctites Dyar. Ins. Ins. Mens., vol. 6, p. 126, 1918.

A very large mosquito with dusky wings and white-ringed legs, differing only from *ciliata* in lacking the raised scales on the legs and palpi. These parts are smooth, with ordinary vestiture; but the coloration throughout is as in *ciliata*.

The larvae and life habits are unknown. It may be an aberration of *ciliata* or a distinct species.

Distribution.—Southern States.

United States Records.

TEXAS: Brownsville, August 28, 1916 (M. M. High).
GEORGIA: Augusta, July 28, 1921 (S. F. Hildebrand).

PSOROPHORA (PSOROPHORA) HOWARDII Coquillett.

Psorophora howardii COQUILLETT, Can. Ent., vol. 8, p. 258, 1901.
Psorophora virescens DYAR and KNAB, Proc. Biol. Soc. Wash., vol. 19, p. 133, 1906.

A large brilliant blue or green mosquito. Mesonotum with smooth nude areas, a band of grayish white scales on the sides. Abdomen blue dorsally, the last two segments green in the female, venter blackish scaled. Wings smoky. Legs dull yellowish, the ends of the tibiae with somewhat raised black scales, the tarsi black, with narrow white rings at the bases of the first two joints.

The larvae are predaceous on other mosquito larvae occurring in ground puddles, generally *Aëdes*, *A. infirmatus* being a common victim. They seem to prefer shaded pools, where the other *Psorophora* are less common.

Distribution.—Central America, Mexico, and southern United States, Cuba.

United States Records.

MARYLAND: Piney Point, June 25, 1900 (T. Pergande).
DISTRICT OF COLUMBIA: Chain Bridge, August 2, 1908 (T. Pergande).
NORTH CAROLINA: Charlotte, June 16, 1916 (H. P. Barret).
SOUTH CAROLINA: Hartsville, July 23, 1901 (C. Coker).
FLORIDA: Miami, September 22, 1921 (G. F. Moznette).
Tampa, March 18, 1905 (H. G. Dyar).
MISSISSIPPI: Sibley (A. Fleming).
ARKANSAS: Scott (J. K. Thibault).

Subgenus JANTHINOSOMA Lynch Arribalzaga.

PSOROPHORA (JANTHINOSOMA) SAYI Dyar and Knab.

Culex musicus SAY (not Leach), Journ. Acad. Nat. Sci. Phila., vol. 6, p. 149, 1827.
Culex posticatus COQUILLETT (not Wiedemann), U. S. Dept. Agr., Div. Ent., Circl. 40, ser. 2, p. 6, 1900.
Janthinosoma discrucians GILES (not Walker), Gnats or Mosq., ed. 2, p. 339, 1902.
Janthinosoma mexicanum BLANCHARD (not Bellardi), Les Moust., p. 234. 1905.

Janthinosoma sayi DYAR and KNAB, Journ. N. Y. Ent. Soc., vol. 14, p. 181, 1906.

Janthinosoma sayi THEOBALD, Mon. Culic., vol. 4, p. 155, 1907.

A large brown mosquito, the hind legs shortly shaggy and tipped with white. Palpi, legs, and abdomen black with blue reflections. Head with dense erect golden scales; mesonotum with sparse golden scales; abdomen blue-black dorsally, with lateral triangular apical segmental yellow patches, confluent with the golden yellow venter; legs blue-black, the vestiture of the hind pair shortly erect, tip of third tarsal and all of the fourth and fifth white. Wings slightly smoky, the scales narrow, all dark.

The larvae live in temporary rain puddles, and develop rapidly. The period of larval life is very short. The winter is passed in the egg state, the eggs being spinose and adapted to withstand desiccation. The adult is generally rare, but conspicuous when seen. It will bite in daytime in the open, but is never numerous enough to be troublesome.

Distribution.—Atlantic and Gulf States to southern Ontario, Cuba, and Bahamas. This is a northern subspecies of *Psorophora posticatus* Wiedemann of tropical America.

United States Records.

MASSACHUSETTS: Springfield, July 16, 1903 (F. Knab).
DISTRICT OF COLUMBIA: Washington, September 9, 1901 (W. E. Hinds).
VIRGINIA: Glencarlyn, July 23, 1901 (N. Banks).
 Luray, September 2, 1906 (F. Knab).
NORTH CAROLINA: Greensboro, August 8, 1901 (F. C. Pratt).
SOUTH CAROLINA: Columbia, August 1, 1906 (———).
GEORGIA: Brunswick, May 21, 1915 (R. H. Von Ezdorf).
FLORIDA: West Tampa, March 18, 1905 (H. G. Dyar).
MISSISSIPPI: Agricultural College, May 18, 1901 (G. W. Herrick).
LOUISIANA: Mound, June 12, 1915 (S. L. Walker).
TENNESSEE: Athens, August, 1904 (H. S. Barber).
KENTUCKY: Corbin, August 24, 1904 (H. S. Barber).
MISSOURI: Charleston, June 14, 1918 (K. C. Sullivan).
ARKANSAS: Helena, July 30, 1904 (H. S. Barber).
TEXAS: Dallas, August 31, 1906 (F. C. Pratt).
WISCONSIN: Saxeville, July 29, 1909 (B. K. Miller).
IOWA: Algonquin (H. J. Quayle).

PSOROPHORA (JANTHINOSOMA) HORRIDUS Dyar and Knab.

Aëdes horridus DYAR and KNAB, Proc. U. S. Nat. Mus., vol. 35, p. 56, 1908.

A large black mosquito, with shaggy blue-black legs, the last two hind tarsal joints white. Thorax black scaled in the middle, the sides broadly yellowish white scaled; head yellowish white scaled. Abdomen blue-black, with apical segmental lateral yellowish spots;

venter pale yellow. Legs blue-black, the femora yellowish toward base and beneath, the scales on the tibiae and basal tarsal joints of the hind legs raised, the last two joints snowy white. Wings smoky, with narrow dark scales.

The larvae doubtless live in temporary ground pools, but unfortunately have not come under observation.

Distribution.—Southern United States. This is doubtless to be considered as a northern race of the tropical American *Psorophora lutzii* Theobald.

United States Records.

MARYLAND: Plummer Island, July 18, 1904 (R. P. Currie).
DISTRICT OF COLUMBIA: Washington, July 21, 1909 (T. Pergande).
VIRGINIA: Woodstock, August 4, 1904 (F. C. Pratt).
TEXAS: Dallas, June 24, 1904 (H. S. Barber).
Brownsville, August 29, 1916 (M. M. High).
MISSISSIPPI: Westpoint, August 11, 1904 (H. S. Barber).
ARKANSAS: Vanburen, July 6, 1904 (H. S. Barber).
TENNESSEE: Chattanooga, July 27, 1904 (H. S. Barber).
MISSOURI: Charleston, June 18, 1918 (K. C. Sullivan).
INDIAN TERRITORY: Wister, July 2, 1904 (H. S. Barber).

We have no records of this species from the southern Atlantic States, though it occurs in the Potomac watershed.

PSOROPHORA (JANTHINOSOMA) DISCRUCIANS Walker.

Culex discrucians WALKER, Ins. Saund., p. 430, 1856.
Janthinosoma arribalzagae GILES, Gnats, and Mosq., ed. 2, p. 339, 1902.
Conchyliastes varipes COQUILLETT, Can. Ent. vol. 36, p. 10, 1904.

A medium-sized blackish mosquito, bluish and silvery marked, a white ring before the tip of the hind legs. Mesonotum black scaled in the middle, yellowish silvery on the sides; head yellowish white scaled. Abdomen blue-black, with lateral whitish patches, apically situated on the segments, but running well toward their bases; venter yellowish, with broad black bands at the apices of the segments. Legs black-scaled, smooth, femora yellowish at base and beneath, the hind tarsi with the fourth joint white, the fifth black. Wings smoky, scales dark.

The larvae occur in ground pools. A specimen was bred from a cacao husk. The life history is very imperfectly known.

Distribution.—Mississippi Valley, Mexico, and Central America, absent in the central Tropics, reappearing in southern Brazil and Argentina. It is possible that the northern form should be separated under the name *Psorophora varipes* Coquillett; but there is not sufficient material before us to make the necessary comparisons of all stages.

United States Records.[10]

MISSISSIPPI: Clarksdale, August 1, 1904 (H. S. Barber).
LOUISIANA: Mound, May 29, 1915 (A. H. Jennings).
ARKANSAS: Scott, September 1, 1908 (J. K. Thibault).
INDIAN TERRITORY: Wister, July 7, 1904 (H. S. Barber).
MISSOURI: Charleston, June 11, 1918 (K. C. Sullivan).

PSOROPHORA (JANTHINOSOMA) CYANESCENS Coquillett.

Culex cyanescens COQUILLETT, Journ. N. Y. Ent. Soc., vol. 10, p. 137, 1902.

A large blue-black mosquito with reddish yellow femora. Head and mesonotum sparsely scaled with yellowish, the black integument showing; abdomen blue-black, with apical segmental pale golden bands; venter pale golden scaled, the terminal segments black in the middle. Legs blue-black, smoothly scaled, the femora rather conspicuously reddish yellow. Wings smoky, the veins dark scaled.

The larvae develop rapidly in temporary rain puddles. Mr. J. K. Thibault says:

> The appearance of this mosquito immediately after rains is so strikingly characteristic that even people who never pay much attention to such things notice it. They are out in force for several days after a rain and then only a few will be found till the next rain.

It does not enter houses, but is very persistent out of doors, even in bright sunlight, and will often pursue a person. It is said never to voluntarily quit biting, but must be brushed off. Specimens have been seen on a horse for hours, voiding the surplus blood and sucking fresh.

Distribution.—Gulf States and Mexican coastal region to Yucatan; also in Colombia.

United States Records.

KANSAS: Wellington, May, 1908 (E. O. G. Kelly).
ARKANSAS: Fort Smith, July 8, 1904 (H. S. Barber).
LOUISIANA: Shreveport, June 23, 1905 (H. A. Morgan).
MISSISSIPPI: Sibley, July 9, 1921 (A. Fleming).
TEXAS: Paris. June 17, 1907 (F. C. Bishopp).
Brownsville, August 30, 1916 (M. M. High).

Subgenus GRABHAMIA Theobald.

PSOROPHORA (GRABHAMIA) SIGNIPENNIS Coquillett.

Taeniorhynchus signipennis COQUILLETT, Proc. Ent. Soc. Wash., vol. 6, p. 167, 1904.

A medium-sized yellowish mosquito with spotted wings. Mesonotal integument blackish, with fine brassy scales, with irregular

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[10] The specimen recorded from Georgia in the monograph is not in the collection. It was probably misidentified and afterwards removed.

mottled reflection. Abdomen blackish, with whitish scales over most of the surface, leaving oblique paired lines on each segment; venter peppered black and whitish. Legs blackish, densely peppered, the femora with a pale ring before tip. Tarsi with broad white rings at the bases of the joints, the first hind tarsal also broadly white in the middle, leaving only a black ring near base and at tip. Wing scales black and whitish, three black marks on the costal edge, the first at middle, the last apical; a spot on the sixth vein; fringe conspicuously spotted. Proboscis broadly whitish in the middle.

The larvae develop rapidly in temporary rain pools in arid country. The adults bite much as the other prairie species, by day as well as evening, in the open. The males swarm after sunset over the prairie.

Distribution.—Arid valleys west of the Mississippi from northern Mexico to Montana.

United States Records.

MONTANA: Glasgow, July 11, 1921 (H. G. Dyar).
Poplar, July 20, 1921 (H. G. Dyar).
Laurel, July 16, 1917 (H. G. Dyar).
TEXAS: Camp McAllen, August 28, 1921 (Army Medical Museum).
San Antonio (Army Medical Museum).
Austin, August 10, 1908 (A. W. Morrill).
Laredo (T. D. Berry).
NEW MEXICO: Mesilla, October 4, 1898 (T. D. A. Cockerell).
ARIZONA: Willcox, July 31, 1909 (A. K. Fisher).

PSOROPHORA (GRABHAMIA) DISCOLOR Coquillett.

Culex discolor COQUILLETT, Can. Ent., vol. 35, p. 256, 1903.

A medium-sized light-brown mosquito with mottled wings. Mesonotal integument blackish, covered with fine pale golden scales, not obscuring the integument. Abdomen peppered, with apical pale bands, forming a median pale line. Wings with the costa dark, a pale mark at outer third, but not spotted; wing scales dark and pale, dense in spots, forming mottlings, especially at base of third vein, forks of second and fourth, a line on upper fork of fifth. Legs peppered, femora with a pale ring before apex; tarsi with white rings at the bases of the joints, the hind tibia also broadly whitish in the middle. Proboscis with broad whitish ring.

This species is much like *signipennis*, but the wings do not have the conspicuous costal spots. The larvae live in temporary rain puddles, but not in the arid regions, preferring a more abundant rainfall. The larvae are peculiar, for whereas all the other *Psorophora* larvae, with the exception of the predaceous species, have greatly enlarged air tubes, this one has a small air tube, but greatly enlarged antennae. We have no observations on the biting habits.

Distribution.—Southern States to Mexico.

United States Records.

New Jersey: Delair, June 28 (W. P. Seal).
District of Columbia: Washington, September 9, 1901 (J. Kotinsky).
Virginia: Grassymead, May 24 (H. G. Dyar).
North Carolina: Charlotte, May 5, 1915 (H. P. Barret).
Mississippi: Clarksdale, July 31, 1904 (H. S. Barber).
Louisiana: Baton Rogue (J. W. Dupree).
Texas: Plano, May (E. S. Tucker).
Brownsville, August 30, 1916 (M. M. High).

PSOROPHORA (GRABHAMIA) COLUMBIAE Dyar and Knab.

Janthinosoma texanum Dyar and Knab, Proc. Biol. Soc. Wash., vol. 19, p. 135, 1906.

Janthinosoma columbiae Dyar and Knab, Proc. Biol. Soc. Wash., vol. 19, p. 135, 1906.

Janthinosoma columbiae Dyar and Knab, Proc. Biol. Soc. Wash., vol. 19, p. 135, 1906.

A rather large blackish mosquito. Mesonotum with brown or bluish scales, more or less frosted, with irregular reflection, sometimes forming paired spots. Abdomen black, with paired oblique whitish powdery spots at the apices of the segments, spreading and diffuse posteriorly. Legs black, the femora with white rings before the apex; tibiae spotted with white on the outside; tarsi with white rings at the bases of the joints, the first joint also with a whitish ring in the middle. Wing scales black, peppered with white, forming a black spot at the base of the third vein. Proboscis with a whitish ring in the middle.

The larvae occur in ground pools filled with rain water, and develop rapidly. The adults are not very troublesome, although they are said to bite, but without leaving a severe irritation.

A number of names were applied to this species, which was also considered identical with *Psorophora jamaicensis* Theobald of the Antilles. The present arrangement on the basis of the male genitalia may be found discussed by Dyar.[11]

Distribution.—Cuba, the Bahamas, Florida, and Texas northward.

United States Records.

New York: Cold Spring Harbor, July 17, 1901 (F. E. Lutz).
New Jersey: Delair, July 10, 1901 (W. P. Seal).
Maryland: Hyattsville, August, 1906 (A. Busck).
District of Columbia: Washington, (W. V. Warner).
Virginia: Woodstock, June 6, 1900 (F. C. Pratt).
West Virginia: Kanawha Station, July 20, 1907 (A. D. Hopkins).
Georgia: Atlanta, July 4, 1906 (W. B. Summerall).
North Carolina: Greensboro, August, 1901 (F. C. Pratt).

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[11] Ins. Ins. Mens., vol. 8, p. 140, 1920.

FLORIDA: Jacksonville, July 2, 1906 (H. Byrd).
Kissimmee, March 19, 1905 (H. G. Dyar).
Miami, October 29, 1921 (G. F. Moznette).
MISSISSIPPI: Tutweiler, August 2, 1904 (H. S. Barber).
LOUISIANA: New Orleans, January 7, 1904 (S. G. Gill).
TEXAS: Llano Grandee, September, 1916 (R. S. Cleaner).
San Antonio (Army Medical Museum).
Brownsville, August 29, 1916 (M. M. High).
ILLINOIS: Carbondale, May 27, 1918 (S. C. Chandler).
MISSOURI: Sikeston, September 8, 1921 (M. F. Boyd).
KENTUCKY: Corbin, August 24, 1904 (H. S. Barber).
TENNESSEE: Rives, July 27, 1904 (H. S. Barber).
ARKANSAS: Little Rock, July 11, 1904 (H. S. Barber).

PSOROPHORA (GRABHAMIA) PYGMAEA Theobald.

Grabhamia pygmaea THEOBALD, Mon. Culic., vol. 3, p. 245, 1903.
Culex nanus COQUILLETT, Can. Ent., vol. 35, p. 256, 1903.
Taeniorhynchus antiguae GILES, Journ. Trop. Med., vol. 7, p. 362, 1904.

A rather small blackish mosquito. Mesnotal integument blackish, vestiture gray, frosted, with irregular reflection, appearing spotted. Abdomen black, with broad apical segmental whitish bands, produced in the middle; venter light gray. Legs blackish, the femora with small pale ring before apex; tarsi with small white rings at the bases of the joints, the first joint not different from the others. Wing scales black and white, evenly peppered. A whitish ring on the proboscis.

The larvae occur in temporary ground pools. We have no observations on the biting habits. The species much resemble *columbiae;* but is smaller and less brightly colored.

Distribution.—Antilles, Bahamas, and Florida Keys.

United States Records.

FLORIDA: Key West, April 1, 1903 (E. A. Schwarz).

Genus AEDES Meigen.

Aëdes MEIGEN, Syst. Beschr. Bek. Eur. Zweifl. Ins., vol. 1, p. 13, 1818.
Heteronycha LYNCH ARRIBALZAGA, Rev. Mus. de la Plata, vol. 1, p. 373, 1891.
Ochlerotatus LYNCH ARRIBALZAGA, Rev. Mus. de la Plata, vol. 1, p. 374, 1891.
Taeniorhynchus LYNCH ARRIBALZAGA, Rev. Mus. de la Plata, vol. 1, p. 374, 1891.
Stegomyia THEOBALD, Journ. Trop. Med., vol. 4, p. 159, 1901
Gilesia THEOBALD, Mon Culic., vol. 3, p. 238, 1903.
Acartomyia THEOBALD, Mon. Culic., vol. 3, p. 251, 1903.
Finlaya THEOBALD, Mon. Culic., vol. 3, p. 281, 1903.
Howardina THEOBALD, Mon. Culic. vol. 3, p. 287, 1903.
Aedimorphus THEOBALD, Mon. Culic., vol. 3, p. 290, 1903.
Skusea THEOBALD, Mon. Culic., vol. 3, p. 291, 1903.

Verrallina Theobald, Mon. Culic., vol. 3, p. 295, 1903.
Macleaya Theobald, Entom., vol. 36, p. 154, 1903.
Catageiomyia Theobald, Thomps. Yates & Johnst. Lab. Repts., vol. 5, pt. 2, p. 1, 1903.
Culicelsa Felt, Bull. 79, N. Y. Sta. Mus., p. 391*b*, 1904.
Culicada Felt, Bull. 79, N. Y. Sta. Mus., p. 391*b*, 1904.
Ecculex Felt, Bull. 79, N. Y. Sta. Mus., p. 391*c*, 1904.
Protoculex Felt, Bull. 79, N. Y. Sta. Mus., p. 391*d*, 1904.
Scutomyia Theobald, Entom., vol. 37, p. 77, 1904.
Danielsia Theobald, Entom., vol. 37, p. 78, 1904.
Hulecoeteomyia Theobald, Entom., vol. 37, p. 163, 1904.
Pseudoculex Dyar, Proc. Ent. Soc. Wash., vol. 7, p. 45, 1905.
Gualteria Lutz, Imprensa Med., p. 65, 1905.
Phagomyia Theobald, Gen. Ins., Dipt., 26 fasc., p. 14. 1905.
Polyleptiomyia Theobald, Gen. Ins., Dipt., 26 fasc., p. 15, 1905.
Lepidotomyia Theobald, Gens. Ins., Dipt., 26 fasc., p. 15, 1905.
Reedomyia Ludlow, Can. Ent., vol. 37, p. 94, 1905.
Pecomyia Theobald, Journ. Econ. Biol., vol. 1, p. 23, 1905.
Pseudograbhamia Theobald, Journ. Bombay Nat. Hist., vol. 16, p. 243, 1905.
Chrysoconops Goeldi, Os Mosq. no Para, p. 114, 1905.
Gymnometopa Coquillett, Proc. Ent. Wash., vol. 7, p. 183, 1905.
Lepidoplatys Coquillett, Science, n. s., vol. 23, p. 134, 1906.
Quasistegomyia Theobald, 2d Rep. Wellc. Res. Lab., p. 69, 1906.
Duttonia Newstead, Ann. Trop. Med. & Par., vol. 1, p. 17, 1907.
Pseudoskusea Theobald, Mon. Culic., vol. 4, p. 192, 1907.
Pseudohowardina Theobald, Mon Culic., vol. 4, p. 223, 1907.
Neomacleaya Theobald, Mon. Culic., vol. 4, p. 228, 1907.
Protomacleaya Theobald, Mon. Culic., vol. 4, p. 253, 1907.
Banksinella Theobald, Mon. Culic., vol. 4, p. 468, 1907.
Mimeteculex Theobald, 3d Rep. Wellc. Res. Lab., p. 258, 1908.
Geitomyia Leicester, Stud. Ins. Med. Res., Fed. Mal. Sta., vol. 3, pt. 3, p. 134, 1908.
Aioretomyia Leicester, Stud. Ins. Med. Res., Fed. Mal. Sta., vol. 3, pt. 3, p. 185, 1908.
Kingia Theobald, Mon. Culic., vol. 5, p. 135, 1910.
Myxosquamus Theobald, Mon. Culic., vol. 5, p. 225, 1910.
Nepecomyia Theobald, Mon. Culic., vol. 5, p. 261, 1910.
Stenoscutus Theobald, Mon. Culic., vol. 5, p. 263, 1910.
Bathosomyia Theobald, Mon. Culic., vol. 5, p. 135, 1910.
Molpemyia Theobald, Mon. Culic., vol. 5, p. 479, 1910.
Leslieomyia Christophers, Paludism, No. 2, p. 68, 1911.
Andersonia Strickland, Entom., vol. 44, p. 250, 1911.

A large genus of world-wide distribution, varying greatly in habit, in general addicted to temporary water. The lower members of the group occur in water in containers, tree holes, etc., and one of these has become domestic and is the well-known vector of yellow fever. Other species of *Aëdes* of this subgenus (*Stegomyia*) are said to transmit dengue and filariosis. The higher members of the genus frequent ground pools. A large section of the genus is restricted to the northern and Arctic regions, the larvae developing in the snow water of spring. These species are often abundant and annoying, but none of them are known to convey diseases of man.

The genus has been divided into a number of subgenera on the characters of the male genitalia. The groups occurring in the United States may be separated as follows:

1. Claspette present ------ 2.
Claspette absent ------ 3.
2. Sidepiece with apical and basal lobes ------
Subgenus **Heteronycha** Lynch Arribalzaga.
Sidepiece with basal lobe, no apical one ------
Subgenus **Taeniorhynchus** Lynch Arribalzaga.
Sidepiece without lobes ------ Subgenus **Finlaya** Theobald.
3. A hairy or spinose lobe at base of sidepiece ------ 4.
Without this structure; basal membrane expanded or modified ------
Subgenus **Stegomyia** Theobald.
4. Lobe at base of sidepiece complex; clasper modified, furcate and with a basal branch ------ Subgenus **Aëdes** Meigen.
This lobe simple; clasper without basal branch, though sometimes modified at apex ------ Subgenus **Ecculex** Felt.

KEY TO THE UNITED STATES SPECIES OF AËDES.

1. Tarsi with white rings on both ends of the joints ------ 2.
Tarsi with white rings basally on the joints ------ 6.
Tarsi without white rings ------ 16.
2. Wing scales markedly bicolored ------ 3.
Wing scales uniformly dark, or nearly so ------ 4.
3. Larger species; wing veins evenly mottled ------ **campestris** Dyar and Knab.
Smaller species; third vein darker scaled than adjoining ones.
dorsalis Meigen.
4. Mesonotum uniformly brown, or nearly so ------ **canadensis** Theobald.
Mesonotum ornamented, striped or spotted ------ 5.
5. Mesonotum pale, with broad dark median stripe ------ { **epactius** Dyar and Knab. **atropalpus** Coquillett.
Mesonotum pale yellowish with dark spots ------ **varipalpus** Coquillett.
Mesonotum pale golden before, varied with brown behind; tarsal pale rings almost wholly basal ------ **fluviatilis** Lutz.
6. Proboscis of the female white ringed ------ 7.
Proboscis of the female without white ring ------ 11.
7. Abdomen with a longitudinal dorsal pale stripe ------ 8.
Abdomen without a dorsal pale stripe ------ 10.
8. Wing scales wholly dark ------ **mitchellae** Dyar.
Wing scales dark and light mixed ------ 9.
9. Abdomen with sides and dorsal stripe concolorous ------ **nigromaculis** Ludlow.
Abdomen with white lateral spots, not concolorous with dorsal stripe.
sollicitans Walker.
10. Last joint of hind tarsi white ------ **taeniorhynchus** Wiedemann.
Last joint black, white at base ------ **portoricensis** Ludlow.
11. Mesonotum with lyre-shaped silvery marking ------ **aegypti** Linnaeus.
Without such markings ------ 12.
12. Tarsal pale rings broad, especially on hind legs ------ 13.
Tarsal pale rings narrow; mesonotum uniformly brown ------ 15.

13. Large yellowish species; abdomen suffused with yellow scales ---- **flavescens** Müller. / **aloponotum** Dyar. / **riparius** Dyar and Knab.

Somewhat smaller species with little yellow, the abdomen more or less concretely banded ---- 14.

14. Wing scales narrow, normal ---- **excrucians** Walker. / **mutatus** Dyar. / **increpitus** Dyar. / **mississippii** Dyar. / **classicus** Dyar. / **stimulans** Walker. / **albertae** Dyar. / **mercurator** Dyar. / **fitchii** Felt and Young. / **mimesis** Dyar. / **palustris** Dyar.

Wing scales broad, inflated ---- **grossbecki** Dyar and Knab. / **squamiger** Coquillett.

15. Terminal abdominal segments with normal pale bands ---- **vexans** Meigen.

Terminal abdominal segments largely pale scaled ---- **cantator** Coquillett.

16. Mesonotum yellow in the integument, with two black spots; scaling inconspicuous ---- **bimaculatus** Coquillett.

Mesonotum brown, normal, scaled ---- 17.

17. Mesonotum marked with silver ---- 18.

Mesonotum dark with two yellow stripes ---- **trivittatus** Coquillett.

Mesonotum otherwise marked ---- 19.

18. Mesonotum with a broad silvery patch before ---- **infirmatus** Dyar and Knab.

Mesonotum with broad silvery area reaching far back ---- **dupreei** Coquillett.

Mesonotum with narrow median silvery line ---- **atlanticus** Dyar and Knab. / **tormentor** Dyar and Knab.

Mesonotum silvery at the sides, dark brown centrally ---- **triseriatus** Say.

19. Abdomen with continuous, or nearly so, white lateral line ---- **cinereus** Meigen.

Abdomen transversely banded or unbanded, the lateral spots never joined ---- 20.

20. Wing scales markedly bicolored ---- 21.

Wing scales uniformly dark, or nearly so ---- 23.

21. Mesonotum brown and gray intermixed; wing veins mostly black, with white scales subcostally and in cell ---- **niphadopsis** Dyar and Knab.

Mesonotum longitudinally striped; wing veins black and white alternating ---- 22.

22. Abdomen with median dorsal abdominal pale stripe ---- **spencerii** Theobald.

Abdomen generally without the median stripe ---- **idahoensis** Theobald.

23. Mesonotum typically with central broad undivided dark band ---- 24.

Mesonotum with divided central dark band or none ---- 26.

24. Mesonotum contrastingly yellow at the sides ---- 25.

Mesonotum creamy yellow at the sides ---- **aestivalis** Dyar. / **hirsuteron** Theobald.

Mesonotum golden or reddish brown at the sides; median stripe sometimes divided or mesonotum uniformly dark brown ---- **punctor** Kirby.

Mesonotum light yellowish at the sides, with illy contrasted median brown band ---- **prolixus** Dyar.

25. Yellow lateral lines straight and narrow ---- **aurifer** Coquillett.

Yellow lines broad, narrowed posteriorly ---- **thibaulti** Dyar and Knab.

26. Mesonotum with paired brown lines---------------------------------- 27.

Mesonotum uniformly colored, without lines------------------------ 28.

27. Mesonotum golden yellowish, the lines very narrow, well apart; a very small species--**gonimus** Dyar and Knab.

Mesonotum yellowish, lines usually narrow and well separated; a very small species--**aldrichi** Dyar and Knab.

Mesonotum yellow (or gray), sometimes more or less suffused with brown centrally, the margin remaining yellow; lines narrow, sometimes obsolete; medium sized species----
dysanor Dyar.
lazarensis Felt and Young.

Mesonotum yellow-brown, with two rather narrow dark lines; a small species --**altiusculus** Dyar.

Mesonotum gray with dark lines, usually largely overspread with brown centrally; medium sized species---------------------------**masamae** Dyar.

Mesonotum gray with dark lines, usually little overspread with brown centrally; two white spots often on disk-------------------**tahoënsis** Dyar.

Mesonotum yellow (rarely gray), the dark lines broad heavy, well contrasted and passing back around the antescutellar space; a larger species.
pionips Dyar.

Mesonotum yellow, lines slender, often conjoined into a median stripe; legs very deep black-------------------**diantaeus** Howard, Dyar, and Knab.

Mesonotum yellow, the side stripes darker and heavier than the median pair; a small species------------------------------------**cyclocerculus** Dyar.

Mesonotum yellow, lines moderate, normal; a medium sized species.
leuconotips Dyar.

Mesonotum yellow to brown, variable, lines present or absent.
hexodontus Dyar.

Mesonotum yellow to brown, lines distinct, broad, sometimes joined mesially; a large species--**aboriginis** Dyar.

Mesonotum gray with central brown shade; lines fine, dark; a small species.
impiger Walker.

Mesonotum mossy yellow; lines narrow and very approximate.
pullatus Coquillett.

Mesonotum very light yellow, lines broad, black-----------**iridipennis** Dyar.

28. Thorax with long hairs, especially below---------- ----
alpinus Linnaeus.
nearcticus Dyar.

Thorax with normal setae in the female---------------------------- 29.

29. Mesonotum light gray, with traces of dark lines, or a central brown shade, sometimes covering the whole mesonotum; a small species.
cataphylla Dyar.

Mesonotum dark gray, often with whitish shades at each side; a large species-----
trichurus Dyar.
cineroborealis Felt and Young.

Mesonotum uniformly dark brown; a medium sized species, very fond of entering houses--**intrudens** Dyar.

Mesonotum with illy contrasted dark lines or uniformly brown; an arctic species from the coast of Alaska----------------------**punctodes** Dyar.

Mesonotum uniformly dark brown; venter with longitudinal black stripe.
fisheri Dyar.

Mesonotum uniformly golden brown; abdomen spotted---------**thelcter** Dyar.

Mesonotum olivaceous brown, darker shaded centrally, sometimes with diffused paired brown lines-----------------------------**ventrovittis** Dyar.

As indicated above, the variation in color of the mesonotum is considerable, so that the characters overlap on all sides, and specimens occur which cannot be correctly placed with any table. The male genitalia are necessary for determination in such cases, especially in the subgenus *Heteronycha*, where the confusion due to this variability is likely to be greatest.

KEY TO THE UNITED STATES SPECIES OF HETERONYCHA BY THE MALE GENITALIA.

1. Basal lobes modified, obsolete as such, but leaving a large spine on one side and two approximate setae on the other, the latter sometimes obsolete. (Group **Pullatus**) 2.
Basal lobes more or less developed ---------- 4.
2. Basal lobe large with two stout spines ---------- 3.
Basal lobe small, with two stout spines ---------- **pullatus** Coquillett.
Basal lobe absent, no basal spines ---------- **aurifer** Coquillett.
3. A slight hairy area distal of apical lobe ---------- **intrudens** Dyar.
A strong hairy area proximal of apical lobe. **diantaeus** Howard, Dyar, and Knab.
4. Basal lobe elongate, semidetached, the setiferous part separate from the spine ---------- (Group **Serratus**) 5.
Basal lobe sessile, the setae not apart from the spine, or spine wanting -- 8.
5. Basal lobe of side piece rounded and bulbous ---------- 6.
This lobe elongated, finger shaped ---------- 7.
6. Filament of claspette broadly bladeshaped ---------- **bimaculatus** Coquillett.
Filament of claspette slender ---------- **dupreei** Coquillett.
7. Stem of claspette thick, sinuous ---------- **atlanticus** Dyar and Knab.
Stem of claspette slender, less sinuous ---------- **tormentor** Dyar and Knab.
8. Basal lobe more or less expanded and tubercular, with or without a spine ---------- 9.
Basal lobe uniformly long-haired, no spine ---------- 27.
9. Basal lobe expanded, with many setae, but without a single differentiated long spine; if the marginal spines are thickened, more than one is involved ---------- (Group **Dorsalis**) 10.
Basal lobe with a single differentiated spine, or if absent, the lobe if flat and rugose ---------- 11.
10. Basal lobe without spines on the margin ---------- **canadensis** Theobald.
Basal lobe with coarse spinelike setae on the margin. **campestris** Dyar and Knab.
Basal lobe with two stout spines on the margin ---------- **dorsalis** Meigen.
11. Apical lobe with short flat clinging setae ---------- (Group **Punctor**) 12.
Apical lobe with the setae normal or slightly thickened ---------- 15.
12. Spine of basal lobe a normal spine ---------- 13
This spine greatly thickened and delicate.
spencerii Theobald.
idahoensis Theobald.
hirsuteron Theobald.
aestivalis Dyar.
aldrichi Dyar and Knab.
13. Claspette filament long, sickle shaped ---------- **dysanor** Dyar. **punctodes** Dyar.
Claspette filament short, curved ---------- 14.

14. Spine of basal lobe stout ---- **hexodontus** Dyar.
cyclocerculus Dyar.
leuconotips Dyar
punctor Kirby.

Spine of basal lobe slender ---- **aboriginis** Dyar.
fisheri Dyar.

15. Setae on apical lobe more or less well developed; filament of claspette without retrose spine ---- 16.

Setae on apical lobe practically absent; filament of claspette with retrose spine. (Group **Scapularis.**) ---- **infirmatus** Dyar and Knab.
trivittatus Coquillett.
theloter Dyar.

16. Setae on apical lobe more or less distinctly outwardly directed when the lobe is retracted, not functioning as organs or prehension, tending to obsolescence ---- (Group **Impiger**) 17.

Setae on apical lobe inwardly directed, often distinctly functional, though occasionally obsolescent ---- (Group **Stimulans**) 19.

17. Apical lobe of sidepiece nearly bare ---- **impiger** Walker.
cataphylla Dyar.
niphadopsis Dyar and Knab.

Apical lobe of sidepiece distinctly setose ---- 18.

18. Setae on apical lobe stouter than adjoining ones ---- **prolixus** Dyar.

These setae not stouter than adjoining ones ---- **lazarensis** Felt and Young.
altiusculus Dyar.
masamae Dyar.
tahoensis Dyar.
pionips Dyar.

19. Basal lobe of sidepiece without a spine or tuft of setae, flat; apical lobe with short normal setae ---- 20.

Basal lobe with a strong distinct spine, free; accompanied by few setae; lobe flat; apical lobe with normal setae ---- 22.

Spine of basal lobe strong or weak, accompanied by many setae; basal lobe conical; apical lobe with short, slightly thickened, somewhat curved setae ---- 25.

20. Rugose area of basal lobe reaching up to apical lobe ---- **excrucians** Walker.

This area not reaching beyond middle of sidepiece ---- 21.

21. Filament of claspette angularly expanded beyond middle; spines of ninth tergites longer ---- **increpitus** Dyar.

Filament of claspette angularly expanded toward base, spines of ninth tergites shorter ---- **mutatus** Dyar.

22. Basal lobe rugose nearly to apical lobe; filament of claspette angularly expanded at basal third ---- **flavescens** Müller.

Basal lobe round, not longer than broad, rugose; filament of claspette expanded at middle ---- 23.

Basal lobe a small setiferous area next to the spine; filament of claspette thick, angularly bent in middle ---- **cantator** Coquillett.

23. Setae of apical lobe coarser than the ordinary vestiture ---- **mississippii** Dyar.

Setae of apical lobe about the same size as the vestiture ---- 24.

Setae of apical lobe distinctly weaker than the vestiture ---- **albertae** Dyar.

Setae of apical lobe very small and short ---- **mercurator** Dyar.

24. Claspette filament long, slender and pale with an angle beyond the middle. **stimulans** Walker.

Claspette filament moderately long, thick and dark, roundedly swollen near the middle ---- **classicus** Dyar.

25. Filament of claspette shortly and slenderly sickle shaped, with more or less distinct basal notch..........26.
Filament of claspette with a broad expansion the whole length; basal lobe highly conical with strong spine..........**riparius** Dyar and Knab.
Filament of claspette short and smoothly widened; basal lobe moderate with very strong spine..........**grossbecki** Dyar and Knab.
Filament of claspette long, angularly widened at middle; basal lobe moderate, with strong spine..........**squamiger** Coquillett.

26. Spine of basal lobe fairly strong; spines of ninth tergites long. **fitchii** Felt and Young.
Spine of basal lobe weaker; spines of ninth tergites long..........**mimesis** Dyar.
Spine of basal lobe much weaker; spines of ninth tergites very long. **palustris** Dyar.

27. Apical lobe with short, curved, clinging setae. (Group **Thibaulti**) **thibaulti** Dyar and Knab.
Setae on apical lobe normal..........28.

28. Setae on apical lobe long, more or less outwardly directed. (Group **Trichurus**) **cinereoborealis** Felt and Young.
Setae on apical lobe very short and few, inwardly directed. (Group **Alpinus**) { **alpinus** Linnaeus. **nearcticus** Dyar. }

Subgenus HETERONYCHA Lynch Arribalzaga.[12]

Group SERRATUS.

AËDES (HETERONYCHA) BIMACULATUS Coquillett.

Culex bimaculatus COQUILLETT, Proc. U. S. Nat. Mus., vol. 25, p. 84, 1902.

A rather large yellow mosquito. Mesonotum yellow, yellow scaled, two black spots posteriorly in the integument. Abdomen black, with broad yellow basal segmental bands, the terminal segments wholly yellow; venter yellow. Legs yellow, the femora and tibiae black at their tips; first tarsal joint yellow with black tip, the remaining joints black, the second with a little yellow at base. Wings slightly infuscated, scales dark, the costa and first vein broadly yellow nearly to apex. Proboscis yellow with black tip.

The larvae live in muddy ground puddles following rain. The form is doubtless a race of the tropically distributed *Aëdes fulvus* Wiedemann. The mosquito is of very striking coloration, but extremely rare, so that it can not be considered troublesome.

Distribution—Southern States.

United States Records.

TEXAS: Brownsville, August 30, 1916 (M. M. High).
LOUISIANA: New Orleans, September 10, 1914 (W. V. King).
ARKANSAS: Scott, September 28, 1909 (J. K. Thibault).

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[12] This subgeneric name becomes *Ochlerotatus* Lynch Arribalzaga in case *Heteronycha* is referred to the synonymy of *Culex*.

MISSISSIPPI: Natchez, June 9, 1910 (A. Fleming).
NORTH CAROLINA: Charlotte, July, 1916 (H. P. Barret).

AËDES (HETERONYCHA) DUPREEI Coquillett.

Culex dupreei COQUILLETT, Can. Ent., vol. 36, p. 10, 1904.

A very small mosquito, the mesonotum broadly silvery in the middle the whole length in the female, brown at the sides, the whole mesonotum silvered in the male; head silvery scaled. Abdomen black above, with lateral segmental white spots in the female, broad basal segmental bands in the male; venter pale. Legs black, the femora white below toward base, a pale line along the underside of tibiae and tarsi. Wing scales dark.

The larvae live in ground puddles and on account of the very long tracheate anal gills are able to remain down and seldom come to the surface. The larvae are therefore difficult to collect, and as the adults are hardly ever met with, the species is rare in collections.

Distribution.—Atlantic and Gulf States, probably extending to Central America. Some of the records in the monograph[18] are in error. The specimen from Washington, District of Columbia, is *triseriatus;* that from Trinidad is *oligopistus*, thus leaving the only southern record Costa Rica, which depends upon unbred larvae, without adults.

United States Records.

NEW JERSEY: New Brunswick, August 1 (J. B. Smith).
LOUISIANA: Baton Rouge (J. W. Dupree).
ARKANSAS: Scott, July 11, 1909 (J. K. Thibault).

AËDES (HETERONYCHA) ATLANTICUS Dyar and Knab.

Aëdes atlanticus DYAR and KNAB, Journ. N. Y. Ent. Soc., vol. 14, p. 198, 1906.

A medium-sized blackish mosquito, the mesonotum with a rather narrow silver line in the middle the whole length. Abdomen black, with basal segmental lateral white patches; venter pale. Legs black, the femora white below. Wing scales all dark.

The larvae occur in temporary ground pools, usually swampy and with vegetation. The adults are seldom seen. This species is said to differ from *tormentor* by having the hind tibiae dark below while those of the other species are narrowly pale. The character is difficult to observe, elusive and probably not constant. The only certain distinction between the two is the male genitalia.

Distribution.—Southern States.

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[18] Howard, Dyar, and Knab, Mosq. No. & Cent. Am. & W. I., vol. 4, p. 781, 1917.

United States Records.

LOUISIANA: New Orleans, September 28, 1914 (W. V. King).
FLORIDA: Sanford, March 17, 1906 (H. G. Dyar).
GEORGIA: Brunswick, May 21, 1915 (R. H. von Ezdorf).
NORTH CAROLINA: Wilmingtom, August 16, 1918 (R. W. Leiby).
White Lake, June, 1915 (F. Sherman)
Charlotte, June 14, 1916 (H. P. Barret).
DISTRICT OF COLUMBIA: Chain Bridge, September 29, 1906 (T. Pergande).
NEW JERSEY: New Brunswick, August 1 (J. B. Smith).

AËDES (HETERONYCHA) TORMENTOR Dyar and Knab.

Aëdes tormentor DYAR and KNAB, Journ. N. Y. Ent. Soc., vol. 14, p. 191, 1906.

A medium-sized blackish mosquito, the mesonotum with a rather narrow silver line in the middle the whole length. Abdomen black, with basal segmental lateral white patches; venter pale. Legs black, the femora white below. Wing scales all dark.

The species is rare, and no notes on the habits are at hand. The colorational difference between this species and *atlanticus* given in the monograph seems to be illusory, and the habitats overlap much more than there indicated. They may even be coëxtensive. The genitalia easily separate the two when males are at hand, otherwise the separation is uncertain.

Distribution.—Southern States.

United States Records.

LOUISIANA: New Orleans, September 15, 1914 (W. V. King).
ARKANSAS: Scott, August 31, 1908 (J. K. Thibault).
MISSISSIPPI: Westpoint, August 14, 1904 (H. S. Barber).
Corinth, August 14, 1904 (H. S. Barber).
FLORIDA: Jacksonville (H. Byrd).

Group SCAPULARIS.

AËDES (HETERONYCHA) INFIRMATUS Dyar and Knab.

Aëdes infirmatus DYAR and KNAB, Journ. N. Y. Ent. Soc., vol. 14, p. 197, 1906.

A medium-sized blackish mosquito, the mesonotum brown, with a large silvery patch from the front to beyond the middle, not reaching the sides. Abdomen black, with basal segmental lateral white patches; venter whitish, the segments black scaled at their apices. Legs black, the femora white below, tibiae with pale reflection below. The black parts often take a metallic luster. Wing scales all dark. Proboscis black.

The larvae live in temporary ground pools. The adults are sometimes abundant after rains, but they inhabit woods and thickets, and are seldom troublesome, although said to be a persistent biter. This is perhaps to be considered as a northern race of the tropically distributed *Aëdes scapularis* Rondani. There are certain larval differences between the two, which if directly contrasted seem marked; but the Central American form (*euplocamus* Dyar and Knab) is intermediate. The colorational characters given to separate these in the monograph are not constant.

Distribution.—Southern States.

United States Records.

TEXAS: Brownsville, August 31, 1916 (M. M. High).
LOUISIANA: New Orleans, September 15, 1914 (W. V. King).
Mound, October 18, 1913 (D. L. Van Dine).
ARKANSAS: Scott, August 31, 1908 (J. K. Thibault).
FLORIDA: Cutler, November 10, 1921 (G. F. Moznette).
West Tampa, March 18, 1905 (H. G. Dyar).
Bartow, March 20, 1905 (A. N. Caudell).
Homestead, March 12, 1917 (C. A. Mosier).
NORTH CAROLINA: Charlotte, 1920 (H. P. Barret).

AËDES (HETERONYCHA) TRIVITTATUS Coquillett.

Culex trivittatus COQUILLETT, Journ. N. Y. Ent. Soc., vol. 10, p. 193, 1902.
Culex inconspicuus GROSSBECK, Ent. News, vol. 15, p. 333, 1904.
Aëdes angustivittatus DYAR and KNAB, Journ. N. Y. Ent. Soc., vol. 15, p. 9, 1907.

A medium-sized to small brown mosquito. Mesonotum brown, with two rather broad yellow lines the whole length. Head largely yellow scaled. Abdomen black with basal segmental lateral white patches; venter white. Legs black, the femora white beneath; tibiae and first tarsal joint also more or less whitish below. Wing scales all dark. Proboscis black.

The larvae live in ground pools, particularly in river valleys where the pools are filled by flood water. They also occur sparingly in irrigation water. The adults frequent the bushes and trees along the river bottoms, and will bite severely persons going to such places. The form with narrow yellow lines on the mesonotum (*angustivittatus*) is probably not separable specifically, though as yet insufficiently known. It occurs commonly in Panama but also with the normal form.

Distribution.—Panama to the upper Mississippi Valley, through the Potomac Gap to Virginia, and north to Maine.

United States Records.

NEW MEXICO: South Fork Deer Creek Canyon, Peloncillo Mountains, July 27, 1917 (C. H. T. Townsend).
TEXAS: Denison, June 14, 1904 (H. S. Barber).
Camp Stanley, May 24, 1918 (D. L. Van Dine).

COLORADO: Oxford, September 1, 1918 (I. M. Way).
MONTANA: Laurel, July 16, 1917 (H. G. Dyar).
MINNESOTA: Ottertail County, August 21, 1917 (C. W. Howard).
MISSOURI: Cypress Swamp, Mississippi County, June 15, 1918 (L. Haseman).
INDIANA: Lafayette, July 21, 1916 (J. J. Davis).
VIRGINIA: Woodstock, August 4, 1904 (F. C. Pratt).
Addison, July 6, 1916 (A. N. Caudell).
DISTRICT OF COLUMBIA: Chain Bridge, August 31, 1904 (T. Pergande).
MARYLAND: Plummer Island, July 7 (R. P. Currie).
NEW JERSEY: Chester, September 14 (J. B. Smith).
MASSACHUSETTS: Granby, September 12, 1903 (F. Knab).
South Amherst, June 10, 1903 (G. Dimmock).
MAINE: Paris, September 3, 1910 (W. C. Perham).

AËDES (HETERONYCHA) THELCTER Dyar.

Aëdes (*Taeniorhynchus?*) *thelcter* DYAR, Ins. Ins. Mens., vol. 6, p. 129, 1918.

A medium-sized mosquito. Mesonotum entirely dull yellowish scaled, the scaling coarse and thick; head similarly clothed. Abdomen black, with triangular basal segmental median and lateral whitish patches; venter pale. Legs black, the femora pale below, the tibiae and first tarsal joint also more or less pale on the under side. Wing scales all dark. Proboscis black.

The larva has not been found; but the adults occur after heavy rains with other species of similar habit, and the breeding is doubtless in temporary ground pools.

Habitat.—Southern Texas.

United States Records.

TEXAS: Brownsville, August 29, 1916 (M. M. High).
Camp McAllen, August 28, 1921 (Army Medical Museum).

Group PULLATUS.

AËDES (HETERONYCHA) AURIFER Coquillett.

Culex aurifer COQUILLETT, Can. Ent., vol. 35, p. 255, 1903.

A medium-sized or rather large brown-black mosquito. Head golden scaled in the middle and sides, dark brown between. Mesonotum with a very broad median deep blackish brown stripe, leaving the sides narrowly golden yellow. Abdomen black dorsally, with elongate triangular white basal segmental lateral spots; venter mostly whitish. Legs deep black, the femora broadly white below except at the tips. Wing scales narrow, black.

The larvae live in early spring pools, particularly cranberry bogs, hatching from overwintering eggs. The attack of the adult is described as bloodthirsty. The mating habits of the males are unknown. The species is local and rare.

Distribution.—Southern Canada to New Jersey; Minnesota.

United States Records.

Minnesota: Minneapolis, July 2 (K. Taylor).
New Hampshire: Center Harbor, July 22, 1902 (H. G. Dyar).
Dublin, June, 1909 (A. Busck).
Massachusetts: Springfield, May 21, 1903 (F. Knab).
Wilmington, July 4, 1910 (H. S. Barber).
Connecticut: Suffield (G. Dimmock).
Rhode Island: Weekapaug, July 5, 1904 (H. G. Dyar).
New Jersey: Lahaway, April 25 (J. T. Brakeley).

AËDES (HETERONYCHA) PULLATUS Coquillett.

Culex pullatus Coquillett, Proc. Ent. Soc. Ent. Wash., vol. 6, p. 168, 1904.
Aëdes aerophilus Dyar, Ins. Ins. Mens., vol. 5, p. 127, 1917.
Culex jugorum Villeneuve, Bull. Soc. Ent. France, 1919, p. 59, 1919.
Aëdes metalepticus Dyar, Ins. Ins. Mens., vol. 8, p. 51, 1920.
Aëdes gallii Martini, Arch. f. Schiffs- u. Tropenkr., vol. 24, Beih. 1 p. 110, 1920.

A medium-sized black mosquito. Mesonotum dull olivaceous yellow when fresh, fading to mossy whitish; lines distinct, narrow, approximate, median lines normally present, the sides stripes more often obsolete. Abdomen black, the basal segmental white bands narrowed centrally or obsolete dorsally, widened at the sides; venter pale, with dark apical segmental bands. Legs black, the femora pale below; knee spots white. Wing scales narrow, all dark.

The winter is passed in the egg stage. The larvae develop in early ground pools, more especially muddy pools along streams and lakes. They are somewhat late in development, being among the last of the forest species to be found as larvae. The species frequents high altitudes. The males swarm after sunset in openings of the forest or over willows. In the far north, in June, when it is light practically all night, the swarms may be seen as early as 4 o'clock in the afternoon when the sun passes behind a temporary cloud.

Distribution.—Alaska and the Yukon, down the Rocky Mountains to Colorado. Alps of Europe.

United States Records.

Alaska: Camp 327, Alaska Engineering Commission, July 12, 1921 (J. M. Aldrich).
Seward, July 25, 1921 (J. M. Aldrich).
Anchorage, July 21, 1921 (J. M. Aldrich).
Skagway, June 17, 1919 (H. G. Dyar).
Idaho: Juliaetta, April 21, 1889 (J. M. Aldrich).
Montana: Whitefish, June 16, 1921 (H. G. Dyar).
Colorado: Aspen, July 22 (P. Andrews).
Buena Vista, July 3, 1917 (Henderson and Andrews).
Estes Park Village, June 24 (T. D. A. Cockerell).

AËDES (HETERONYCHA) INTRUDENS Dyar.

Aëdes intrudens DYAR, Ins. Ins. Mens., vol. 7, p. 23, 1919.

A medium-sized black mosquito, very fond of entering houses. Head with brown scales on the vertex, a narrow line of black ones on each side, and a patch of creamy ones below. Mesonotum with dark bronzy brown scales, the posterior lateral stripes often showing faintly blackish, with a slender light line within. Abdomen black, with basal segmental white bands, generally not contracted in the middle; venter whitish scaled. Legs black, the femora pale beneath. Wing scales dark.

Liable to be confused with the *abserratus* form of *punctor* or the heavily suffused form of *cataphylla*, the male genitalia abundantly diagnostic in both cases, also similar to the unlined form of *lazarensis;* but that has always a pale margin to the mesonotum, lacking in *intrudens.*

The winter is passed in the egg state. The larvae develop in early ground pools in spring, this being one of the especially early species. The adults are short lived, disappearing comparatively early in the season. This is the most troublesome of the forest mosquitoes, from its habit of entering houses. When large numbers get in, as often happens, sleep is difficult. No other forest species behaves in this manner.

The mating habits of the males have not been observed.

Distribution.—Northern forests, Atlantic to Pacific; Europe (Germany).

United States Records.

NEW YORK: Karner, March 19, 1904 (E. P. Felt).
Elizabethtown, April 23, 1905 (H. G. Dyar).
MASSACHUSETTS: West Springfield, April 13, 1905 (Dyar and Knab).
Longmeadow, April 16, 1905 (Dyar and Knab).
NEW HAMPSHIRE: Dublin, May 28, 1910 (E. C. Stowell).
MONTANA: Whitefish, June 16, 1921 (H. G. Dyar).

AËDES (HETERONYCHA) DIANTAEUS Howard, Dyar, and Knab.

Aëdes diantaeus HOWARD, DYAR, and KNAB, Mosq. No. & Cent. Am. W. I., vol. 4, p. 758, 1917.

Aëdes serus MARTINI, Arch. f. Schiffs- u. Tropenkr., vol. 24, Beih. 1, p. 96, 1920.

A medium-sized black mosquito. Mesonotum yellow, the two median blackish lines distinct, narrow, sometimes joined into a single median stripe; side stripes generally weak. Abdomen black, the white bands obsolete dorsally, forming triangular spots at the sides at the bases of the segments; venter whitish, the segments black at their apices. Legs deep black, the femora white below, broadly so at base. Wing scales narrow, all dark.

Liable to be confused with the normal form of *lazarensis*, from which there is no marked distinction. The form of *diantaeus* with single dark stripe (*serus*) closely resembles the normal form of *punctor* but is more slender, the legs blacker. Male genitalia always diagnostic.

The winter is passed in the egg state. Larvae in early ground pools, especially cold pools in spruce bogs; but in one river valley breeding in flood pools in summer.

The males do not swarm, but attack the females singly as these are attempting to bite some warm-blooded animal.

Distribution.—Northern forests from Atlantic to Pacific, also in northern Europe.

United States Records.

NEW HAMPSHIRE: Dublin, May and June, 1909 (A. Busck).
MONTANA: Belton, June 23, 1921 (H. G. Dyar).

AËDES (HETERONYCHA) IRIDIPENNIS, new species.

A rather large black mosquito, with light yellow mesonotum. Integument black; mesonotum with light yellow scales, paired median and short posterior stripes black, broad. Abdomen black, with narrow basal whitish bands, widening on the sides into triangular spots; venter pale scaled, with interrupted median black line. Legs black, the femora white beneath for two-thirds. Wings iridescent, the scales black, narrow.

Described from a single female specimen, type Cat. No. 25264, U.S.N.M. The species may be found to fall in *Taeniorhynchus* when the male is known. Larvae and life habits unknown.

Distribution.—Arizona and probably southward, a similar specimen having been taken in Colombia.

United States Records.

ARIZONA: Chiricahua Mountains, August 17, 1917 (C. H. T. Townsend).

Group PUNCTOR.

AËDES (HETERONYCHA) PUNCTODES Dyar.

Aëdes punctodes DYAR, Ins. Ins. Mens., vol. 10, p. 2, 1922.

A medium-sized black mosquito. Mesonotum dark brown, with two median darker lines, generally illy contrasted or obsolete, and indistinguishable in flown specimens. Abdomen black, with basal segmental whitish bands, narrowed in the middle somewhat; venter whitish, with sprinkling of black scales. Legs black, the femora whitish beneath; tibiae and first tarsal joint also more or less pale below; knee spots white. Wing scales black.

The larva is unknown, but will doubtless be found to develop in early snow pools.

Distribution.—Alaska, central coastal region, and lower Yukon.

United States Records.

ALASKA: Teller, July 29, 1918 (F. Johannsen).
Anchorage, June 11, 1921 (J. M. Aldrich).
Valdez, June 8, 1921 (J. M. Aldrich).
Nome, August 21, 1916 (F. Johannsen).
Katmai, July, 1917 (J. S. Hine).
St. Michael (Army Medical Museum).
Iditarod, August 29, 1918 (A. H. Twitchell).
Innoko, July 12, 1917 (A. H. Twitchell).
Flat, June 12, 1917 (A. H. Twitchell).
Fairbanks, July 4, 1921 (J. M. Aldrich).
Camp 327, Alaska Engineering Commission, July 12, 1921 (J. M. Aldrich).
Camp 334, Alaska Engineering Commission, June 21, 1921 (J. M. Aldrich).
Hurricane, July 15, 1921 (J. M. Aldrich).
Healy, June 23, 1921 (J. M. Aldrich).
Virgina Bay, June 26, 1899 (T. Kincaid).
Yakutat, June 21, 1899 (T. Kincaid).
Koyukuk River, Summer, 1901 (W. J. Peters).
Goodnews Bay, July 15, 1919 (G. L. Harrington).

AËDES (HETERONYCHA) DYSANOR Dyar.

Aëdes (*Ochlerotatus*) *dysanor* DYAR, Ins. Ins. Mens., vol. 9, p. 70, 1921.

A medium-sized blackish mosquito. Mesonotum yellowish, with two narrow separate brown lines, or a single broad median one. Abdomen black above, the segmental pale basal bands much narrowed centrally, or reduced to lateral spots; venter entirely dull whitish. Legs black, the femora whitish beneath and a small white spot at tip. Wing-scales wholly dark, narrow.

Indistinguishable in coloration from the *punctor* variety of *punctor*. The species is insufficiently known, having been confused with *punctor* until very recently. The larvae have not been differentiated and may not be separable. The male genitalia, however, furnish a reliable character. The species breeds in the early spring pools.

Distribution.—Southern fringe of the evergreen forests. Possibly more widely distributed.

United States Records.

NEW HAMPSHIRE: Dublin, May (A. Busck).
NEW YORK: Plattsburg, April, 1905 (Dyar and Hudson).
WISCONSIN: Saxeville, May 23, 1909 (B. K. Miller).

AËDES (HETERONYCHA) PUNCTOR Kirby.

Culex punctor KIRBY, Richardson's Fauna Bor. Amer., vol. 4, p. 309, 1837.
Culex implacabilis WALKER, List. Dipt. Brit. Mus., vol. 1, p. 7, 1848.
Culex provocans WALKER, List. Dipt. Brit. Mus., vol. 1, p. 7, 1848.
Culex abserratus FELT and YOUNG, Science, n. s., vol. 20, p. 312, 1904.

Culicelsa auroides FELT, Bull. 79, N. Y. State Mus., p. 448, 1905.
Aëdes centrotus HOWARD, DYAR, and KNAB, Mosq. No. & Cent. Am. & W. I., vol. 4, p. 747, 1917.

A rather large blackish mosquito. Mesonotum with dark yellow or gray scales on the sides, a quadrate broad dark-brown band in the middle. Abdomen black, with basal segmental white bands, usually narrow and narrowed centrally; venter white scaled. Legs black, the femora white below. Wing scales wholly dark.

In the East the mesonotum is commonly suffused with brown, with the dark central band still visible (form *centrotus*), to entirely dark brown (form *abserratus*). The latter is difficult to distinguish from *intrudens*. In the West the typical form (*punctor*=*auroides*) predominates, suffused examples being rare. Here the sides of the mesonotum are as often gray as yellow; in the East, always yellow. Another variation which occurs throughout the range, although not abundantly, has the median mesonotal stripe divided, forming two lines. This is very difficult to distinguish from *lazarensis*. Both the forms of *diantaeus*, also, closely resemble corresponding forms of *punctor*. This is, however, generally a larger and more robust mosquito than *diantaeus*, the legs less deep black.

The winter is passed in the egg state, the larvae developing in early spring pools, particularly in spruce swamps. None were found in the flood pools referred to as breeding places for *diantaeus* and others. The adults are severe biters, and can be found till frost in the northern woods, although there is but a single annual generation.

Distribution.—Canadian forests from Atlantic to Pacific, except the rainy Pacific belt; mountains of New England and New York, northern Minnesota, but not the Rocky Mountains.

United States Records.

WISCONSIN: Saxeville, May 23, 1909 (B. K. Miller).
MINNESOTA: Minneapolis, July 6 (K. Taylor).
NEW HAMPSHIRE: Dublin, May, 1909 (A. Busck).
MASSACHUSETTS: Mount Tom, May 6. 1908 (F. Knab).
NEW YORK: Plattsburg, April, 1905 (H. G. Dyar).

AËDES (HETERONYCHA) LEUCONOTIPS Dyar.

Aëdes leuconotips DYAR, Ins. Ins. Mens., vol. 8, p. 24, 1921.

A rather large blackish mosquito. Mesonotum brownish yellow, with two median dark-brown lines and short posterior lateral one of the same color. Abdomen black, with basal segmental white bands, narrow and narrowed centrally; venter white scaled, with some black ones at the tips of the segments. Legs black, the femora white below; knee spots narrowly white. Wing scales all dark.

The markings are not distinguishable from *lazarensis*, although, as seen from the male genitalia and larvae, the species is extremely close to *punctor*. The winter is passed in the egg state, the larvae developing in early muskeg pools in the rainy Pacific coast strip. The mating habits of the males have not been observed.

Distribution.—Pacific coast, British Columbia to Alaska.

United States Records.

ALASKA: Ketchikan, June 20, 1919 (H. G. Dyar).
Cape Fanshaw, June 22, 1919 (H. G. Dyar).

AËDES (HETERONYCHA) CYCLOCERCULUS Dyar.

Aëdes cyclocerculus DYAR, Ins. Ins. Mens., vol. 8, p. 23, 1920.

A medium-sized blackish mosquito. Mesonotum brownish yellow, with two median brown lines, and short thick posterior lateral ones, heavier and blacker than the median ones. Abdomen black, with narrow basal segmental white bands, narrowed centrally; venter whitish scaled. Legs black, mixed with gray scales, especially below, the femora white below. Wing scales wholly dark.

By the male genitalia and larvae, this species is closely allied to *punctor*. It is a rather small species, the winter being passed in the egg state, the larvae developing in early muskeg pools in the rainy Pacific coast strip. The mating habits of the males have not been observed.

Distribution.—Pacific coast, British Columbia to Alaska.

United States Records.

ALASKA: Juneau, June 23, 1919 (H. G. Dyar).
Ketchikan, June 20, 1919 (H. G. Dyar).
Cape Fanshaw, June 22, 1919 (H. G. Dyar).

AËDES (HETERONYCHA) ABORIGINIS Dyar.

Aëdes aboriginis DYAR, Ins. Ins. Mens., vol. 5, p. 99, 1917.

A large blackish mosquito. Mesonotum yellow brown, with two broad central stripes, sometimes confluent, and short thick posterior lateral ones. Abdomen black, with basal segmental narrow white bands; venter white scaled, with more or less distinct black bands at the apices of the segments. Legs black, some whitish scales intermixed; femora white below. Wing scales wholly dark.

The markings of the mesonotum are not separable from *lazarensis*. The form with the mesonotal stripes united is practically as in *punctor*, to which this species is closely allied in the male genitalia; the larvae, however, are distinctive. The winter is passed in the egg state, the larvae developing in early spring pools of a foul character, not in typical muskeg pools. The males have been observed swarming as late as 9 a. m. in bright sunlight, although in deep forest and shaded by the trunks of large trees. The females bite by day or night, as with any other forest mosquito.

Distribution.—Pacific coast, from Washington to Alaska.

United States Records.

WASHINGTON: Longmire Springs, June 17, 1917 (H. G. Dyar).
Ashford, August 1, 1906 (Dyar and Caudell).
Hoquiam, May 27, 1904 (W. E. Burke).
Lake Cushman, June 27, 1917 (H. G. Dyar).

AËDES (HETERONYCHA) HEXODONTUS Dyar.

Aëdes hexodontus DYAR, Ins. Ins. Mens., vol. 4, p. 83, 1916.

A rather large blackish mosquito. Mesonotum dark yellow, with two narrow separated brown lines, which may be wanting, leaving the surface entirely yellow, sometimes pale golden yellow; otherwise suffused with dark brown, or wholly dark brown. Abdomen black, the basal segmental white bands more or less constricted centrally, widening to lateral spots; venter whitish, with more or less distinct blackish apical segmental banding. Legs black, the femora white beneath, and with narrow white tips. Wing scales all dark.

The larvae do not appear till the snow is all gone, hatching in shallow pools in meadows or marshes or along streams, seldom very many larvae in any one pool. The adults will bite in the daytime in shaded places; but their favorite time of flight is after sunset when the darkness is almost complete. For half an hour or more they will come in numbers at this time, then diminish again. The males swarm before sunset, low near the ground behind bushes or tree trunks which the sun is still shining weakly through. After sunset they disappear.

This species is closely allied to *punctor* in the structure of the male genitalia and larvae. The adult coloration is generally not the same.

Distribution.—Mountains of California and Oregon.

United States Records.

CALIFORNIA: Fallen Leaf Lake, Eldorado County, June 10, 1916 (H. G. Dyar).
Tahoe City, Placer County, June 17, 1920 (H. G. Dyar).
Gold Lake, Sierra County, June 28, 1920 (H. G. Dyar).
Gold Lake Camp, Plumas County, June 27, 1920 (H. G. Dyar).
Camp Elwell, Plumas County, June 27, 1920 (H. G. Dyar).
Lakes Center Camp, Plumas County, June 25, 1920 (H. G. Dyar).
OREGON: Crater Lake, July 29, 1920 (H. G. Dyar).
Engineers' Camp, above Whiskey Creek, May 24, 1921 (H. G. Dyar).

AËDES (HETERONYCHA) FISHERI Dyar.

Aëdes fisheri DYAR, Ins. Ins. Mens., vol. 5, p. 19, 1917.

A rather small black mosquito. Mesonotum dark bronzy brown. Abdomen black, the basal segmental bands yellowish, narrowly divided in the middle, the lateral segmental spots triangular; venter with a black median band or largely black. Legs black, the femora more or less whitish beneath and with a few pale scales on the outside; tibiae with a few pale scales. Wing scales black. The male differs notably, having no scales on mesonotum or abdomen, but only long dense black hairs. It is entirely black, without any light markings. The palpi have the last joints thickened and hairy, but only slightly exceeding the proboscis.

The species breeds in early spring pools filled by melting snow banks. At the higher levels these commonly melt slowly enough so that the larvae can mature; but below 7,000 feet altitude this is not always the case. Some pools near the edge of Lake Tahoe which were full of larvae of this species dried rapidly and all perished.

Distribution.—Mountains of Placer County, California.

United States Records.

CALIFORNIA: Lake Tahoe, June 20, 1915 (A. K. Fisher).
Summit, June 22, 1920 (H. G. Dyar).

AËDES (HETERONYCHA) SPENCERII Theobald.

Culex spencerii THEOBALD, Mon. Culic., vol. 2, p. 99, 1901.

A rather small dark-gray mosquito, inhabiting the open grassy prairie. Mesonotum dark brown in the middle, a grayish stripe on each side on the margin and over antescutellar space. Abdomen with diffuse grayish white bands at bases and apices of segments, and a line of the same color down the middle, cutting the black ground into paired squarish spots; venter whitish. Legs black and grayish white, the latter color predominating beneath; femora white below. Wings with the costa, first, third, and fifth veins black scaled, the alternating ones white scaled.

The winter is passed in the egg stage, the larvae developing in early spring pools. The adults inhabit the open prairie, avoiding timber. The males swarm after sunset over prominent objects on the prairie.

Distribution.—Prairies of central Canada and northern edge of the United States.

United States Records.

NORTH DAKOTA: Devils Lake, July 20, 1921 (H. G. Dyar).
Norwich, July 16, 1921 (H. G. Dyar).
Tunbridge, July 16, 1921 (H. G. Dyar).
Rugby, July 16, 1921 (H. G. Dyar).
Knox, July 16, 1921 (H. G. Dyar).
Fargo, July 27, 1921 (H. G. Dyar).
MINNESOTA: East Grand Forks, July 24, 1921 (H. G. Dyar).

AËDES (HETERONYCHA) IDAHOËNSIS Theobald.

Grabhamia spencerii idahoënsis THEOBALD, Mon. Culic., vol. 3, p. 250, 1903.

A rather small dark-gray mosquito, inhabiting open, dry country. Mesonotum dark brown in the middle, a grayish stripe on each side on the margin and over antescutellar space. Abdomen with grayish white bands at the bases of the segments, narrowed centrally, and a few white scales at the apices of the segments also; venter whitish. Legs black and grayish white, the latter color predominating beneath; femora white below. Wings with the costa, first, third, and fifth veins black scaled, the alternating ones white scaled.

In some specimens there is a more or less complete band of pale scales down the middle of the abdomen, and these are indistinguishable from *spencerii*.

The winter is passed in the egg state, the larvae developing in early spring pools. The adults inhabit open country, avoiding timber. The males swarm after sunset over prominent objects. There are larval differences between *idahoënsis* and *spencerii*, and they do not occupy the same territory; but the adults, under exceptional circumstances, may be confused.

Distribution.—Dry valleys from Colorado and Montana to Nevada and Washington.

United States Records.

WASHINGTON: Okanogan (A. K. Millay).
IDAHO: Market Lake (J. M. Aldrich).
Pocatello, June 24, 1904 (E. S. G. Titus).
MONTANA: Bozeman, July 12, 1917 (J. R. Parker).
Drummond, July 10, 1917 (H. G. Dyar).
Missoula, July 6, 1917 (H. G. Dyar).
Whitehall, July 11, 1917 (H. G. Dyar).
Park City, July 14, 1917 (H. G. Dyar).
NEVADA: Elburz, June 25 1908 (H. S. Barber).
Carlin, June 6, 1920 (H. G. Dyar).
UTAH: Ogden, June 20, 1920 (H. G. Dyar).
MONTANA: Big Timber, July 14, 1917 (H. G. Dyar).
Glen, July 10, 1917 (H. G. Dyar).
Laurel, July 16, 1917 (H. G. Dyar).
Lake View, August 2, 1920 (A. N. Caudell).
COLORADO: Whittier Range, Cochetopa National Forest, July 9, 1911 (A. K. Fisher).
Carbondale, July 19, 1917 (P. Andrews).
Florissant, July 4 (T. D. A. Cockerell).

AËDES (HETERONYCHA) HIRSUTERON Theobald.

Culex hirsuteron THEOBALD, Mon. Culic., vol. 2, p. 98, 1901.
Culex pretans GROSSBECK, Ent. News, vol. 15, p. 332, 1904.

A rather small, dark-gray mosquito. Mesonotum dark brown in the middle, gray on the sides and over the antescutellar space. Abdomen black, with basal segmental straight white bands; venter whitish. Wing scales all dark but the costa, first and third veins distinctly darker than the others. Legs black, whitish below, the femora largely white; knee spots white.

The winter is passed in the egg state, the larvae developing in the flood pools of rivers. The eggs must lie on the ground for years awaiting suitable water. In New Jersey the larvae were observed to develop in pools which had not been water filled for 12 years. The eggs, of course, may not have been there that long, although it is possible that they were. The adults are found in woods near the rivers where there have been floods. The species is related to, and possibly a race of, the European *A. sticticus* Meigen.

Distribution.—Eastern United States from the Gulf of Mexico to southern Canada, through the Potomac Gap into Virginia and northward.

United States Records.

TEXAS: Paris, April 4, 1904 (A. A. Girault).
INDIAN TERRITORY: Wister, July 3, 1904 (H. S. Barber).
ARKANSAS: Scott (J. K. Thibault).
MISSOURI: East Prairie, June 17, 1918 (E. V. Rosa, jr.).
TENNESSEE: Rives, July 27, 1904 (H. S. Barber).
Memphis, April 30, 1920 (B. Mayne).
SOUTH DAKOTA: Fort Snelling, June 10, 1906 (E. B. Frick).
VIRGINIA: Woodstock, June 2, 1903 (F. C. Pratt).
MARYLAND: Herzogs Island, April 26, 1903 (W. V. Warner).
NEW JERSEY: Great Piece Meadow, April 27 (J. B. Smith).
CONNECTICUT: Hartford, April 25, 1905 (Dyar and Knab).
MASSACHUSETTS: Westfield, July 14, 1903 (F. Knab).
NEW HAMPSHIRE: Dublin, June, 1905 (A. Busck).

AËDES (HETERONYCHA) AESTIVALIS Dyar.

Culex aestivalis DYAR, Journ. N. Y. Ent. Soc., vol. 12, p. 245, 1904.

A rather small dark-gray mosquito. Mesonotum dark brown in the middle, gray on the sides and over the antescutellar space. Abdomen black, with basal segmental straight white bands; venter whitish. Wing scales all dark, but the costa, first and third veins distinctly darker than the others. Legs black, whitish below, the femora largely white; knee spots white.

The winter is passed in the egg state, the larvae developing in the flood water of lakes. This is probably a synonym of *hirsuteron*, originally separated on supposed larval differences and western distribution, but the characters have lately been shown to be without value.

Distribution.—Vicinity of lakes in the northern Rocky Mountains, Idaho to British Columbia.

United States Records

IDAHO: Sand Point, July 8, 1917 (H. G. Dyar).
MONTANA: Belton, June 23, 1921 (H. G. Dyar).

AËDES (HETERONYCHA) ALDRICHI Dyar and Knab.

Aëdes aldrichi DYAR and KNAB, Proc. U. S. Nat. Mus., vol. 25, p. 57, 1908.
Aëdes vinnipegensis DYAR, Ins. Ins. Mens., vol. 8, p. 84, 1919.

A small dark-gray mosquito. Mesonotum yellowish, with two median dark-brown lines and short posterior lateral ones. Abdomen black, with basal segmental white bands, often narrowed in the middle; venter whitish. Legs black, largely whitish below, the femora white below. Wing scales all blackish.

The larvae occur in river flood water in shaded alder bottoms. The adults are often extremely small, so as to pass through window screens. They inhabit the woods in river bottoms, not coming out into the open country. The swarming of the males occurs in the shade even by day. The adults are voracious biters.

Distribution.—River valleys of the Rocky Mountain watershed, both east and west.

United States Records.

MONTANA: Big Timber, July 14, 1917 (H. G. Dyar).
Laurel, July 16, 1917 (H. G. Dyar).
Youngs Point, July 14, 1917 (H. G. Dyar).
Park City, July 14, 1917 (H. G. Dyar).
IDAHO: Lewiston, June 16, 1902 (J. M. Aldrich).
Market Lake, October 28, 1901 (J. M. Aldrich).
OREGON: Hood River, July 7, 1917 (F. R. Cole).
Montavilla, July 26, 1920 (H. G. Dyar).
WASHINGTON: Oysterville, June 21, 1918 (H. K. Plank).
Sumas, July 15, 1920 (H. G. Dyar).

AËDES (HETERONYCHA) GONIMUS Dyar and Knab.

Aëdes gonimus DYAR and KNAB, Ins. Ins. Mens., vol. 5, p. 165, 1917.

A small blackish mosquito. Mesonotum gray, with slight golden tint; two narrow, hairlike, dark brown lines. Abdomen black, with broad straight basal segmental white bands, widened a little at the sides; venter whitish, with narrow black bands at the apices of the posterior segments. Legs black, the femora whitish beneath. Wing scales all dark, appearing uniform.

The male and larva are unknown, and the species has not recurred to us since the original types. It is surmised that this is a flood species of the *aldrichi* group, but nothing certain is known of it.

Habitat.—Central Texas.

United States Records.

TEXAS: Kerrville, June 20, 1907 (F. C. Pratt).

AËDES (HETERONYCHA) IMPIGER Walker.

Culex impiger WALKER, List Dipt. Brit. Mus., vol. 1, p. 6, 1848.
Aëdes decticus HOWARD, DYAR, and KNAB, Mos. No. & Cent. Amer. & W. I., vol. 4, p. 737, 1917.

A small blackish mosquito. Head gray, with or without black spots. Mesonotum gray on the margins, more or less overspread with brown centrally, and with two median blackish stripes and short posterior lateral ones. Abdomen black, with rather broad basal segmental white bands, usually not narrowed centrally; venter whitish, with apical black segmental bands. Legs black, somewhat mixed with white scales, especially below, femora white below. Wing scales wholly dark. Palpi of the male with few or no white scales.

A description of the markings shows no difference from *lazarensis;* but the habitus is characteristic, and when once learned, the species can generally be recognized. The markings vary in the extent of median brown shading, which may be absent, also the lines may be narrow or broad, even completely filling the mesonotum. The winter is passed in the egg state, the larvae developing in the earliest spring pools. The males swarm low, near the ground, in front of small bushes under trees.

Distribution.—Northern forests from Atlantic to Pacific.

United States Records.

New York: Elizabethtown, April 25, 1905 (H. G. Dyar).
Plattsburgh, April 19, 1905 (H. G. Dyar).
Minnesota: Aitkin County, May 16, 1916 (C. W. Howard).
California: Lake Tahoe, May 6, 1921 (H. G. Dyar).
Alaska: Skagway, June 24, 1919 (H. G. Dyar).

AËDES (HETERONYCHA) CATAPHYLLA Dyar.

Aëdes cataphylla Dyar, Ins. Ins. Mens., vol. 4, p. 86, 1916.
Aëdes prodotes Dyar, Ins. Ins. Mens., vol. 5, p. 118, 1917.

A small blackish mosquito. Mesonotum gray, more or less or not at all overspread with dark brown centrally, sometimes almost completely dark brown, rarely with traces of median paired blackish lines. Abdomen black, with basal segmental white bands, rather broad and usually not narrowed centrally; venter whitish scaled. Legs black, with many white scales intermixed, especially below; femora white below. Wing scales black, often with white ones intermixed, especially along subcostal region. Palpi of the male with many white scales toward the tip of the long joint.

The mesonotal markings run into *impiger* on the one hand and into *intrudens* on the other. It is a small species, like *impiger.* The winter is passed in the egg state, the larvae developing in early spring pools. The females bite both by day and night. The males swarm high over spaces between bushes or small trees in open country.

Distribution.—Northern Rocky Mountains to Alaska, and Sierras of California.

United States Records.

ALASKA: Camp 327, Alaska Engineering Commission, July 18, 1921 (J. M. Aldrich).
Camp 334, Alaska Engineering Commission, July 9, 1921 (J. M. Aldrich).
Seward, July 24, 1921 (J. M. Aldrich).
Healy, July 7, 1921 (J. M. Aldrich).
Hurricane, July 15, 1921 (J. M. Aldrich).
Inspiration Point, July 28, 1919 (H. G. Dyar).
Skagway, June 24, 1919 (H. G. Dyar).
CALIFORNIA: Fallen Leaf Lake, June 20, 1916 (H. G. Dyar).
Tahoe City, June 18, 1920 (H. G. Dyar).
Summit, Placer County, June 20, 1920 (H. G. Dyar).
Little Truckee River, May 6, 1921 (H. G. Dyar).
MONTANA: Bozeman, May 7, 1907 (R. A. Cooley).

AËDES (HETERONYCHA) NIPHADOPSIS Dyar and Knab.

Aëdes niphadopsis DYAR and KNAB, Ins. Ins. Mens., vol. 5, p. 166, 1917.

A medium-sized light-gray mosquito. Mesonotum gray, with brown shade centrally, two narrow black lines and paired white spots, often confused into a mixture of brown and light gray, the females especially showing the less typical marking. Abdomen black with wide basal segmental white bands and scattered scales, forming a more or less developed median line; sometimes the abdomen nearly all white; venter white scaled. Legs black, with many white scales, often more white than black, the femora pale beneath. Wing scales black, those on subcostal vein and vein 3 within the cell, white in part.

The larvae occur in early spring ground pools containing more or less salt water from the mineral springs on the eastern shore of the Great Salt Lake. The adults have a coloration befitting the open desert where they fly; but in all structural points the species is close to *impiger* and *cataphylla.* The larvae show differences, but are somewhat variable and inconstant, as if in a degenerated state.

Distribution.—Eastern shore of Great Salt Lake, Utah.

United States Records.

UTAH: Salt Lake County, April 10, 1914 (C. T. Voorhies).
Salt Lake City, April 15, 1920 (H. G. Dyar).
Garfield, April 22, 1920 (H. G. Dyar).

AËDES (HETERONYCHA) LAZARENSIS Felt and Young.

Culex lazarensis FELT and YOUNG, Science, n. s., vol. 20, p. 312, 1904.
Culex borealis LUDLOW, Can. Ent., vol. 43, p. 178, 1911.

A rather large blackish mosquito. Mesonotum dull yellow, often a little mixed with blackish; two median black-brown lines and short posterior lateral ones, usually both broad and distinct. Abdomen black with basal segmental white bands, often narrowed in the middle; venter whitish scaled, with more or less black at the apices of the segments. Legs black, femora white below; knee spots white narrowly. Wing scales all black.

The coloration of the mesonotum varies from the normal yellow to gray in the Yukon Valley (form *borealis*), and in another variety is more or less overspread with brown. The lines may be narrow, or obsolete, or much extended, in the extreme form rendering the whole mesonotum black.

No colorational characters can be given to separate all forms of *lazarensis* from *punctor*, *diantaeus*, *aboriginis*, *intrudens*, etc.

The winter is passed in the egg state, the larvae developing in early ground pools in forest, and at least in one case in flood pools. The males swarm after sunset at projecting branches of spruce trees and similar locations. The females are good biters, flying in most profusion shortly after dark. This is to be considered a race of the European *Aëdes communis* DeGeer.

Distribution.—Northern forests, from Atlantic to Pacific, except the moist Pacific coast belt.

United States Records.

New York: Elizabethtown, June 11, 1904 (E. P. Felt).
Plattsburgh, April 20, 1905 (H. G. Dyar).
New Hampshire: Mount Washington (A. T. Slosson).
White Mountains (H. K. Morrison).
Dublin, May (A. Busck).
Montana: Belton, June 28, 1921 (H. G. Dyar).
Glacier Park, July 3, 1921 (H. G. Dyar).
Alaska: Eagle (Army Medical Museum).
Healy, June 27, 1921 (J. M. Aldrich).
Camp 334, Alaska Engineering Commission, June 21, 1921 (J. M. Aldrich).
Camp 327, Alaska Engineering Commission, June 12, 1921 (J. M. Aldrich).
Pitchfork Falls, July 28, 1919 (H. G. Dyar).
Skagway, July 8, 1919 (H. G. Dyar).

AËDES (HETERONYCHA) ALTIUSCULUS Dyar.

Aëdes altiusculus Dyar, Ins. Ins. Mens., vol. 5, p. 100, 1917.

A rather small blackish mosquito. Mesonotum dull yellow, with two narrow brown lines, varying in width, sometimes broad and approximate; disk of mesonotum grayish behind. Abdomen black, with basal segmental white bands, narrowing on the sides; venter white, with black bands at the apices of the posterior segments. Legs black, the femora pale beneath. Wing scales all dark.

The larvae occur in the early snow pools on mountain meadows, hatching long before the snow is melted. Larvae were found in a meadow entirely snow covered, in soft spots in the snow, and were collected by dipping in the mixture of snow and water. The species is colored like normal *lazarensis* of the East, and is probably to be considered as an isolated local race thereof. The specimens are rather undersized for *lazarensis* and not of the coloration the species assumes in its nearest occurrence. There are also small larval differences.

Distribution.—Mount Rainier, Washington.

United States Records.

WASHINGTON: Mount Rainier, August 4, 1906 (Dyar and Caudell).
Indian Henry's, Longmire Springs, June 25, 1917 (Allen and Flett).

AËDES (HETERONYCHA) MASAMAE Dyar.

Aëdes (*Heteronycha*) *masamae* DYAR, Ins. Ins. Mens., vol. 8, p. 166, 1920.

A rather large blackish mosquito. Mesonotum gray, with two black lines, the disk overspread with brown in the middle, generally very broadly so, leaving only the narrow margins gray. Abdomen black, basal segmental white bands narrowed centrally; venter white, with more or less developed apical segmental black bands. Legs black, the femora white beneath; knee spots white. Wing scales all dark.

The larvae occur in small pools along little streams from the melting snow, the pools being under trees and just below the snow line. As the snow retreats up the mountain slope, successive pools appear. The adults, hatching from the lower pools, remain only in small part where hatched, but mostly follow up over the unmelted snow for 12 miles or more above the snow line. They are most numerous about the snow line, where they probably attack bears, attracted to the fresh wet grass. They are known locally as "snow mosquitoes" from this habit. This is to be considered as a local race of *lazarensis*.

Distribution.—Mountains about Crater Lake, Oregon.

United States Records.

OREGON: Crater Lake, July 30, 1920 (H. G. Dyar).
Prospect, May 24, 1921 (H. G. Dyar).
Engineer's Camp, above Whiskey Creek, May 24, 1921 (H. G. Dyar).

AËDES (HETERONYCHA) TAHOENSIS Dyar.

Aëdes tahoensis DYAR, Ins. Ins. Mens., vol. 4, p. 82, 1916.

A rather large blackish mosquito. Mesonotum gray, with two black lines, the disk sometimes overspread with brown in the middle, generally not, and never very broadly. Abdomen black, basal segmental white bands narrowed centrally; venter white, with more or less developed apical segmental black bands. Legs black, the femora white beneath; knee spots white. Wing scales all dark.

The larvae hatch long before the snow is all melted. They occur in what become large open pools in ground hollows along the heads of mountain valleys. When the ground is still several feet deep in snow on the general level, these pools will be seen as wet places, perhaps open at one end and containing numerous well-grown larvae, crowding to the opening. After the snow is gone, the larvae and pupae remain for some days, drifting about in masses in the open pools, blown by the wind. The species occur only in the high mountains where suitable conditions occur, and though locally abundant, is incapable of general distribution, and generally annoys no one. It is to be considered as a local race of *lazarensis*, in male genitalia and larval habits the nearest to the European *communis* of any American form.

Distribution.—Mountains of California.

United States Records.

CALIFORNIA: Yosemite Valley, Mariposa County, May, 1907 (D. J. Fullaway).
Fallen Leaf Lake, El Dorado County, June 24, 1916 (H. G. Dyar).
Lake Tahoe, Placer County, June 22, 1920 (H. G. Dyar).
Summit, Placer County, June 15, 1920 (H. G. Dyar).
Gold Lake, Sierra County, June 26, 1920 (H. G. Dyar).
Bear Lake, Plumas County, June 24, 1920 (H. G. Dyar).

AËDES (HETERONYCHA) PIONIPS Dyar.

Aëdes pionips DYAR, Ins. Ins. Mens., vol. 7, p. 19, 1919.

A large blackish mosquito. Mesonotum yellow, clear and even, rarely gray; two median black brown lines, broad and distinct and running far back; two short posterior lateral ones. Abdomen black, with basal segmental white bands, narrowed in the middle; venter whitish scaled, with more or less black at the apices of the segments. Legs black, femora white below; knee spots white. Wing scales all black.

The coloration is not variable as far as observed; but the species is liable to be confused with large specimens of *lazarensis*. The winter is passed in the egg state, the larvae developing in early pools in spruce forests. The species is found only in the deepest forest or in northern regions. The males swarm after sunset in openings in the forest.

Distribution.—Northern forests, presumably from Atlantic to Pacific, although no far eastern records are available, but not in the moist Pacific coast strip.

United States Records.

MONTANA: Lake McDonald, June 25, 1921 (H. G. Dyar).
Two Medicine Lake, July 7, 8, 10, 1921 (H. G. Dyar).
ALASKA: Skagway, June 29, 1919 (H. G. Dyar).

AËDES (HETERONYCHA) PROLIXUS Dyar.

Aëdes prolixus DYAR, Ins. Ins. Mens., vol. 10, p. 1, 1922.

A rather large blackish mosquito. Mesonotum light yellow, with a broad central single brown band. Abdomen black, the pale bands much narrowed dorsally or reduced to lateral spots; venter yellowish white, with apical segmental black bands, triangularly widened and joined medioventrally into a continuous stripe. Legs black, the femora white beneath, tips narrowly white. Wing scales black.

The markings are somewhat softer and less contrasted than in normal *punctor;* but there is no tangible difference. The male genitalia are, however, diagnostic.

The life history is unknown; but there is no reason to suppose that the habits differ from those of its congeners. The larvae will be found to develop from over-wintering eggs in the early spring pools.

Distribution.—Central coastal region of Alaska.

United States Records.

ALASKA: Popoff Island, July 8, 1899 (T. Kincaid).
Valdez, June 8, 1921 (J. M. Aldrich).
Anchorage, July 21, 1921 (J. M. Aldrich).
Hurricane, July 15, 1921 (J. M. Aldrich).

Group DORSALIS.

AËDES (HETERONYCHA) DORSALIS Meigen.

Culex dorsalis MEIGEN, Syst. Besch. bek. Eur. Zweifl. Ins., vol. 6, p. 242, 1830.
Culex maculiventris MACQUART, Dipt Exot., Suppl., vol. 1, p. 7, 1846.
Culex curriei COQUILLETT, Can. Ent., vol. 33, p. 259, 1901
Culex onondagensis FELT, Bull. 79, N. Y. State Mus., p. 278, 1904.
Aëdes quaylei DYAR and KNAB, Journ. N. Y. Ent. Soc., vol. 14, p. 191, 1906.
Culex lativittatus COQUILLETT, Ent. News, vol. 17, p. 109, 1906.
Grabhamia mediolineata LUDLOW, Can. Ent., vol. 39, p. 129, 1907.
Grabhamia broquettii THEOBALD, Entom., vol. 46, p. 154, 1920.
Aëdes grahami LUDLOW, Ins. Ins. Mens., vol. 7, p. 154, 1920.

A rather small yellowish-gray mosquito, the tarsi banded with white, but sometimes very inconspicuously. Mesonotum creamy yellowish, a diffused brown stripe in the middle of variable width, and a little brown on the lateral margins. Abdomen with grayish white basal segmental bands and a longitudinal mid-dorsal line, cutting the black ground into paired quadrate spots; venter pale, with median row of black spots. The pale scales on the abdomen vary, sometimes covering the whole surface. Legs black, with white scales intermixed, femora white below; tarsi with dull white rings at both ends of the joints. Wing scales dark and whitish, rather evenly intermixed, though the third vein is predominatingly dark.

The winter is passed in the egg state, the larvae developing in early ground puddles. The males swarm after sunset over prominent objects on the prairie. The females are persistent biters, especially abundant after sunset.

Distribution.—Europe, Asia, and North America in dry, open country and prairies; central United States to Canada; also as a salt-marsh breeder on the coasts of the Atlantic, Pacific, and Hudson Bay.

United States Records.

WASHINGTON: West Seattle, August 11, 1906 (Dyar and Caudell).
Oroville, June 6, 1919 (A. C. Burrill).
OREGON: Klamath Falls, July 27, 1906 (Dyar and Caudell).
CALIFORNIA: Thrall, July 25, 1906 (Dyar and Caudell).
Niles, August 31, 1901 (C. S. Jones)
Antelope Valley, June 21, 1916 (H. G. Dyar).
NEVADA: Reno, July 24, 1915 (H. G. Dyar).
UTAH: Grand Junction, September 11, 1905 (W. A. Hooker).
COLORADO: Florissant, July 10, 1907 (S. A. Rohwer).
NEW MEXICO: Pecos, June 24 (T. D. A. Cockerell).
IDAHO: Market Lake, June 18, 1901 (J. M. Aldrich).
MONTANA: Laurel, July 16, 1917 (H. G. Dyar).
NORTH DAKOTA: Devils Lake, July 17, 1921 (H. G. Dyar).
NEBRASKA: Lincoln, May (———).
WISCONSIN: Madison (S. J. Holmes).
MINNESOTA: East Grand Forks, July 22, 1921 (H. G. Dyar).
ILLINOIS: Chicago, May 4, 1900 (O. A. Johannsen).
MASSACHUSETTS: Boston, July 16, 1906 (C. W. Johnson).
NEW YORK: Ithaca, May 16, 1900 (O. A. Johannsen).
PENNSYLVANIA: Philadelphia, June 15, 1918 (H. Hornig).
LOUISIANA: Delta, June 20, 1904 (E. S. G. Titus).

AËDES (HETERONYCHA) CAMPESTRIS Dyar and Knab.

Aëdes campestris DYAR and KNAB, Journ. N. Y. Ent. Soc., vol. 15, p. 213, 1907.
Aëdes callithotrys DYAR, Ins. Ins. Mens., vol. 8, p. 16, 1920.

A rather large yellowish-gray mosquito, the tarsi banded with white, but sometimes very inconspicuously. Mesonotum creamy yellowish, a diffused brown stripe in the middle of variable width, and a little brown on the lateral margins. Abdomen with grayish white basal segmental bands, and a longitudinal mid-dorsal line, cutting the black ground into paired quadrate spots; venter pale, with median row of black spots. The pale scales on the abdomen vary, sometimes covering the whole surface. Legs black, with white scales intermixed, femora white below; tarsi with dull white rings at both ends of the joints. Wing scales dark and whitish, rather evenly intermixed.

The winter is passed in the egg state; the larvae occur early in ground pools, often charged with mineral matter. The males swarm after sunset close in the tops of small pine trees. The females bite by day or night, whenever one comes into their haunts.

Distribution.—Utah and northward, very local, but usually abundant where it occurs.

United States Records.

ALASKA: Skagway, June, 1919 (H. G. Dyar).
UTAH: Elsinore, August 6, 1907 (E. S. G. Titus).
Garfield, May 6, 1920 (H. G. Dyar).
MONTANA: Glasgow, July 15, 1921 (H. G. Dyar).
NORTH DAKOTA: Niles Siding, July 16, 1921 (H. G. Dyar).
Devils Lake, July 17, 1921 (H. G. Dyar).
MINNESOTA: East Grand Forks, July 24, 1921 (H. G. Dyar).

AËDES (HETERONYCHA) CANADENSIS Theobald.

Culex canadensis THEOBALD, Mon. Culic., vol. 2, p. 8, 1901.
Culex nivitarsis COQUILLETT, Proc. Ent. Soc. Wash., vol. 6, p. 168, 1904.

A medium-sized, dark-brown mosquito, with conspicuously ringed tarsi. Mesonotum dark brown, with more or less distinct paired narrow light-golden lines. Abdomen commonly unbanded dorsally, black, with triangular white lateral spots at the bases of the segments; venter whitish scaled. Legs black, the femora whitish beneath; tarsi with white rings involving both ends of the joints, broader on the hind tarsi, the last hind tarsal all white. Wing scales wholly dark.

The winter is passed in the egg state, the larvae developing in transient ground puddles, open woods pools and roadside ditches. The larvae will appear several times in a season, following successive filling of the pools by rain, but this probably does not indicate more than one annual generation, only that some of the eggs did not hatch at the first filling of the pool. The adults are persistent biters, being fond of attacking low, near the ground. The males swarm after sunset.

Distribution.—Gulf States to southern Canada, westward in the warmer timbered country to British Columbia.

United States Records.

FLORIDA: Orange City Junction, March 20, 1905 (Dyar and Caudell).
Jacksonville, March 2, 1905 (Dyar and Caudell).
SOUTH CAROLINA: Hartsville, June 25, 1901 (W. C. Coker).
NORTH CAROLINA: Wilmington, March 4, 1919 (M. Kisliuk, jr.).
VIRGINIA: Mount Vernon, April 29, 1903 (W. V. Warner).
KENTUCKY: Corbin, August 24, 1903 (H. S. Barber).
MARYLAND: Bladensburg, June 17, 1903 (F. C. Pratt).
PENNSYLVANIA: Shenks Ferry, October 14, 1901 (S. E. Weber).
NEW YORK: Ithaca, May 4, 1903 (O. A. Johannsen).
MASSACHUSETTS: Cummington, May 30, 1903 (F. Knab).

NEW HAMPSHIRE: Center Harbor, May 16, 1902 (H. G. Dyar).
MAINE: Caribou, August 17, 1906 (E. M. Patch).
MONTANA: Drummond, July 10, 1917 (H. G. Dyar).
Bozeman, July 12, 1917 (H. G. Dyar).
ARKANSAS: Scott, April 28, 1909 (J. K. Thibault).

Group STIMULANS.

AËDES (HETERONYCHA) EXCRUCIANS Walker.

Culex excrucians WALKER, Ins. Saund., p. 429, 1856.
Culex abfitchii FELT, Bull. 79, N. Y. State Mus., p. 381, 1904.
Culex siphonalis GROSSBECK, Can. Ent., vol. 36, p. 332, 1904.
Aëdes sansoni DYAR and KNAB, Can. Ent., vol. 41, p. 102, 1909.
Aëdes euedes HOWARD, DYAR, and KNAB, Mosq. No. & Cent. Am. & W. I., vol. 4, p. 714, 1917.

A rather large brown mosquito with ringed legs. Mesonotum yellowish gray on the sides, a broad reddish brown or dark brown band in the middle, joining the short posterior stripes but variable, sometimes all brown. Abdomen blackish, with basal segmental white bands, widening on the sides, and some white scales on the apices of the segments also; venter whitish, with a row of black dashes on middle line. Legs black, with many white scales intermixed on femora and tibiae, the tarsi with white rings at the bases of the joints, broad on the hind pair. Wings with black scales, with more or less white ones intermixed, especially along costal region.

The adult females are not certainly distinguishable from *fitchii* or *stimulans*. This is commonly a larger species than *fitchii*, the sides of the mesonotum more shaded with brown, often completely so. The wing scales commonly have few or no white scales; but all the characters are intergradient, and not of diagnostic value. The larvae and male genitalia differ conspicuously in the three species.

The winter is passed in the egg stage, the larvae developing in early spring water, woods-pools, and marshes. There is but one annual generation, though the adults last most of the summer, flying in the woods. The species does not enter houses.

Distribution.—Northern forests from New Jersey to Canada, westward to British Columbia, Yukon Valley, and Alaska.

United States Records.

NEW JERSEY: New Brunswick (J. A. Grossbeck).
NEW YORK: Watkins, May 18, 1920 (H. G. Dyar).
Plattsburg, April 24, 1905 (H. G. Dyar).
MASSACHUSETTS: Wilmington, July, 1910 (H. S. Barber).
MINNESOTA: St. Paul, June 16, 1916 (C. W. Howard).
WISCONSIN: Saxeville, May 22, 1909 (B. K. Miller).

AËDES (HETERONYCHA) MUTATUS Dyar.

Aëdes mutatus DYAR, Ins. Ins. Mens., vol. 7, p. 24, 1919.

A rather large brown mosquito with ringed legs. Mesonotum gray, with two median brown bands and short side stripes, more or less mixed with the gray and mottled, forming pale spots. Abdomen black, with basal segmental white bands, the posterior ones strongly widened at the sides; venter pale, with more or less distinct black spots at the bases of the segments mesially. Legs black, the femora and tibiae pale below; tarsi black, with broad white rings at the bases of the joints, except the last joint. Wing scales black, some white ones sometimes present subcostally.

The larvae live in pools along rivers, following the high water of spring. They have a short air tube like ordinary *Aëdes* larvae. The adults frequent timbered country till late in the season. The species is to be considered a race of *increpitus* Dyar.

Distribution.—Rocky Mountain region, British Columbia to New Mexico.

United States Records.

WASHINGTON: Spokane, July 12, 1917 (H. G. Dyar).
IDAHO: Juliaetta, April 21, 1899 (J. M. Aldrich).
MONTANA: Missoula, July 6, 1917 (H. G. Dyar).
  Drummond, July 10, 1917 (H. G. Dyar).
  Bozeman, July 12, 1917 (H. G. Dyar).
  Evaro, July 7, 1917 (H. G. Dyar).
  Laurel, July 16, 1917 (H. G. Dyar).
UTAH: Salt Lake County, April 12, 1914 (C. T. Voorhies).
WYOMING: Yellowstone Park, July 27, 1907 (W. E. Britton).
COLORADO: Florissant, July 4 (T. D. A. Cockerell).

AËDES (HETERONYCHA) INCREPITUS Dyar.

Aëdes increpitus DYAR, Ins. Ins. Mens., vol. 4, p. 87, 1916.

A large blackish mosquito with ringed legs. Mesonotum gray, a brown central band and short posterior side stripes, more or less confused and mottled. Abdomen black, with basal segmental white bands; on the posterior segments some white scales at the tips of the segments also; venter white, with traces of basal segmental black spots. Legs black, with many white scales intermixed, femora and tibiae pale below; tarsi with white rings at the bases of the joints, broadest on the hind legs, except the fifth joint. Wing scales usually wholly black.

The larvae live in spring pools in river valleys and edges of lakes. The larva has a short air tube. The adults live a long time in timbered country. The males swarm after sunset over bushes and small trees.

Distribution.—Forested regions of California and Nevada.

United States Records.

CALIFORNIA: Yosemite, May 14, 1916 (H. G. Dyar).
Fallen Leaf, June 4, 1916 (H. G. Dyar).
Tahoe City, June 20, 1920 (H. G. Dyar).
Clio, June 9, 1916 (H. G. Dyar).
Eureka, May 26, 1903 (H. S. Barber).
Pacific Grove, July 2, 1903 (I. MacCracken).
NEVADA: Glenbrook, August 25, 1915 (H. G. Dyar).

AËDES (HETERONYCHA) FLAVESCENS Müller.

Culex flavescens MÜLLER, Faun. Ins. Friedrichdalina, p. 87, 1764.
Culex lutescens FABRICIUS, Syst. Ent., p. 800, 1775.
Culex variegatus SCHRANK, Enum. Ins. Austr., p. 482, 1781.
Culex bipunctatus ROBINEAU-DESVOIDY, Mém. Soc. Nat. Hist. Paris, vol. 3, p. 405, 1827.
Culex flavus MOTSCHULSKY, Bull. Soc. Imp. Nat. Mosc., vol. 32, p. 503, 1859.
Culex arcanus BLANCHARD, Les Moust., p. 308, 1905.
Culex fletcheri COQUILLETT, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 11, p. 20, 1906.
Aëdes cyprius LUDLOW, Ins. Ins. Mens., vol. 7, p. 158, 1920.

A large yellowish mosquito. Mesonotum dark yellow on the sides, a broad brown median band, contiguous to faint short posterior lateral stripes. Abdomen largely or wholly overspread with yellow scales, sometimes restricted to basal bands, but diffused and with scattered scales; venter yellowish, with black scales intermixed. Legs mostly yellow scaled, the tarsi black, with basal white rings on the joints, those on the hind legs large. Wings with the scales yellowish and black, the light ones predominating.

The winter is passed in the egg state, the larvae developing in the larger ground pools on the prairie in early spring. The mating habits of the male have not been observed in America. Wesenberg-Lund describes them interestingly for the European form.[14] The adults are not abundant, but occasionally met with on prairies and open woodlands. Liable to be confused with the little-known *riparius* which belongs to the *fitchii* series, but is exactly like this in coloration.

Distribution.—Canadian prairies, Montana to Wisconsin; sporadically in Arctic regions, Hudson Bay, and Alaska, Europe and Asia.

United States Records.

MONTANA: Dillon, August 4, 1908 (R. A. Cooley).
Big Fork, November 14, 1904 (E. Ricker).
NORTH DAKOTA: Devils Lake, July 19, 1921 (H. G. Dyar).
MINNESOTA: East Grand Forks, July 24, 1921 (H. G. Dyar).
Fort Snelling, June 10, 1908 (E. B. Frick).
ALASKA: Anchorage, July 10, 16, 19, 1921 (J. M. Aldrich).

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[14] Mem. Acad. Roy. Sci. Lett. Danemark, Sec. Sci., sec. 8, vol. 7, pp. 154–156, 1921.

AËDES (HETERONYCHA) ALOPONOTUM Dyar.

Aëdes aloponotum DYAR, Ins. Ins. Mens., vol. 5, p. 98, 1917.

A large reddish-brown mosquito, with ringed legs. Mesonotum more or less reddish in the integument, clothed with reddish-brown scales, nearly uniform in color and showing no gray except posteriorly. Abdomen black, with basal segmental yellowish white bands and scattered scales; venter pale yellowish, with median basal segmental black spots. Legs black, the femora and tibiae with many yellowish scales intermixed, pale beneath except tip of tibia; first tarsal joint pale nearly to tip, the rest black with basal white rings, broad on the hind legs. Wing scales black, with more or less pale yellowish ones toward costal region.

The male, larva and habits are unknown. Scattered females only have been taken. It is surmised that this may be a race of *flavescens*, but nothing certain is known.

Distribution.—Western Washington and British Columbia.

United States Records.

WASHINGTON: Ashford, August 1, 1906 (Dyar and Caudell).
Hoodsport, July 7, 1920 (H. G. Dyar).
Lake Cushman, June 28, 1917 (H. G. Dyar).

AËDES (HETERONYCHA) MERCURATOR Dyar.

Aëdes mercurator DYAR, Ins. Ins. Mens., vol. 8, p. 13, 1920.

A large blackish mosquito with ringed legs. Mesonotum clear gray on the sides, a little yellowish; a broad red-brown band in the center and posterior short side stripes. Abdomen black above, with narrow basal segmental white bands, widening to triangular spots on the sides; venter pale gray, with medioventral black band, except on the posterior segments. Legs black with white scales intermixed, the femora and tibiae pale below; tarsi black, with white rings at the bases of the joints, those on the hind legs broad. Wing scales wholly dark.

This form, considered to be a race of *stimulans*, develops in river flood pools, apparently flood filled, not seepage filled. The adults frequent the wooded areas in the river valleys and vicinity. The description is made from the types; but the coloration doubtless varies, so that the species can not be distinguished from its allies except by the male genitalia.

Distribution.—Upper Yukon Valley in Canada, doubtless in Alaska at least as far as the southward bend of the river; but no males are at hand. Females of this type have been taken at many points in Alaska, but it is impossible to make a positive determination without the male.

United States Records.

None.

AËDES (HETERONYCHA) ALBERTAE Dyar.

Aëdes albertae DYAR, Ins. Ins. Mens., vol 8, p. 12, 1920.

A large blackish mosquito with ringed legs. Mesonotum clear gray on the sides, a little yellowish; a broad red-brown band in the center and posterior short side stripes. Abdomen black above, with narrow basal segmental white bands, widening to triangular spots on the sides; venter whitish, with posterior segmental black bands and a narrow median black line. Legs black with white scales intermixed, the femora and tibiae pale below; tarsi black, with white rings at the bases of the joints, those on the hind legs broad. Wing scales wholly dark.

This form, considered to be a race of *stimulans*, develops in early spring ground pools, having been taken in the same pool with *impiger*. The larva differs slightly from that of *stimulans* proper.

Distribution.—Province of Alberta, Canada.

United States Records.

None.

AEDES (HETERONYCHA) STIMULANS Walker.

Culex stimulans WALKER, List Dipt. Brit. Mus., vol. 1, p. 4, 1848.
Culicida subcantans FELT, Bull. 97, N. Y. State Mus., p. 448, 1908.

A rather large brown mosquito with ringed legs. Mesonotum yellowish gray on the sides, a broad reddish brown or dark brown band in the middle, joining the short posterior stripes. Abdomen blackish, with basal segmental white bands, widening in the sides, and some white scales on the apices of the segments also; venter whitish, with a row of black dashes on middle line. Legs black, with many white scales intermixed on femora and tibiae, the tarsi with white rings at the bases of the joints, broad on the hind pair. Wings with black scales, many white ones intermixed, especially along costal region, but also on the other veins. There are no reliable color differences between this and *excrucians* and *fitchii.*

The winter is passed in the egg state, the larvae developing in river pools, which have been overflowed by high water. This species, with the other two mentioned, is common through the northern forests; but it is not possible to determine one from the other by the females alone, which makes exact records scarce.

Distribution.—Northern forests, from New England to Canada.

United States Records.

MASSACHUSETTS: West Springfield, April 13, 1905 (F. Knab).
Mount Holyoke, April 15, 1905 (F. Knab).

NEW YORK: Plattsburg, April 24, 1905 (H. G. Dyar).
MICHIGAN: Detroit, May, 1909 (F. B. Lowe).

AËDES (HETERONYCHA) CLASSICUS Dyar.

Aëdes stimulans classicus DYAR, Ins. Ins. Mus., vol. 7, p. 113, 1920.

A large brown mosquito with large white ringed legs. Mesonotum gray at the sides, mixed with brown and a broad red-brown central band, the marking indistinct and confused. Abdomen black, with white basal segmental bands, also many white scales scattered over the surface, the penultimate segment almost wholly white; venter white, with a narrow broken central black line. Legs black, the femora, tibiae, and first tarsal joint with as many white scales as black ones; tarsi beyond the first joint with few white scales, and basal white rings, broad on the hind legs. Wing scales black, with many white ones, on the costal half of the wing as many white as black.

The larvae occur in ground pools, associated with *canadensis*, evidently without relation to flood water. The late John B. Smith treated this form well under the name *cantans* in his Report on Mosquitoes (New Jersey Agricultural Experiment Station, 1905). It is to be considered a race of *stimulans*.

Distribution.—Southern New York and New Jersey.

United States Records.

NEW YORK: Fort Wadsworth, May 20, 1920 (Army Medical Museum).
NEW JERSEY: Hudson County, May 19, 1920 (W. R. Bryce-Delaney).
Newark, March 28 (J. B. Smith).
Morristown, May 1 (J. B. Smith).
Short Hills, May 17, 1906 (W. W. Renwick).
New Brunswick, May 10 (J. B. Smith).

AËDES (HETERONYCHA) MISSISSIPPII Dyar.

Aëdes stimulans mississippii DYAR, Ins. Ins. Mens., vol. 8, p. 113, 1920.

A large brown mosquito with ringed legs. Mesonotum yellowish gray on the sides, shaded with brown centrally, but diffused and appearing almost unicolorous brownish. Abdomen black, with basal segmental white bands and scattered white scales, venter grayish white with traces of median black line. Legs black, with white scales intermixed on femora and tibiae; tarsi black with moderate basal white rings. Wing scales black, with white ones intermixed in costal region.

This form is considered a race of *stimulans*; but is at present known in only two specimens, bred from water in a tree stump, associated with *Orthopodomyia signifer* Coquillett.

Distribution.—Mississippi.

United States Records.

MISSISSIPPI: Electric Mills (J. A. Le Prince).

AËDES (HETERONYCHA) CANTATOR Coquillett.

Culex cantator COQUILLETT, Can. Ent., vol. 35, p. 255, 1903.

A medium-sized brown mosquito, with very small tarsal rings. Mesonotum reddish brown, a little gray over the antescutellar space, median and posterior lateral bands faintly darker. Abdomen black, with dull-white basal segmental bands, excavated centrally, the scales also somewhat diffused and occupying most of the last segment dorsally; venter whitish, with median black spots. Legs blackish brown, the femora white below; tarsi with very narrow white rings at the bases of the joints. Wing scales wholly blackish.

Very much like *vexans* in coloration, but wholly unrelated thereto. The coloration of the abdomen furnishes the best differentiation.

The winter is passed in the egg state, the larvae developing in salt-marsh pools along the Atlantic littoral, several generations succeeding each other, according as the pools are filled by exceptionally high tides or rains. The females travel some miles inland, and become annoying far from their breeding places. The mating habits of the males have not been described.

Distribution.—Atlantic coast from Maryland to Maine.

United States Records.

MAINE: Lincolnville, August, 1907 (H. G. Dyar).
Portland, September 5, 1920 (Army Medical Museum).
MASSACHUSETTS: Melrose Highlands, May 22, 1908 (F. B. Lowe).
RHODE ISLAND: Weekapaug, July 22, 1908 (H. G. Dyar).
CONNECTICUT: New Haven, May 12, 1904 (H. L. Viereck).
NEW YORK: Sheepshead Bay, July 22, 1900 (H. C. Weeks).
Center Moriches, September, 1908 (P. Fowler).
Bellport (H. G. Dyar).
Babylon, July 1, 1903 (W. W. Hewlett).
Northport, July 7, 1903 (J. P. Heyen).
NEW JERSEY: Summit, May 6 (La Rue Holmes).
Salt Meadows, April 10 (H. H. Brehme).
South Orange, July 20, 1903 (S. Miller).
Fort Hancock (Army Medical Museum).
MARYLAND: Chesapeake Beach, August 31, 1913 (F. Knab).

AËDES (HETERONYCHA) FITCHII Felt and Young.

Culex fitchii FELT and YOUNG, Science, new series, vol. 20, p. 312, 1904.

A rather large brown mosquito with ringed legs. Mesonotum yellowish gray on the sides, a broad reddish brown or dark brown band in the middle, joining the short posterior stripes. Abdomen blackish, with basal segmental white bands, widening on the sides, and some white scales on the apices of the segments also; venter whitish, with a row of black dashes on middle line. Legs black, with many white scales intermixed on femora and tibiae, the tarsi with white rings at the bases of the joints, broad on the hind pair. Wings with black scales, with more or less white ones intermixed, especially along costal region.

The adult females are not certainly distinguishable from *excrucians* and *stimulans*. This species is commonly smaller than those and often has many white scales on the wings, the mesonotum is often clear gray on the sides, but none of the characters hold. The species is less closely addicted to forests than *excrucians*, being common on the prairies where some cover exists, and in the half-open country of the Yukon region. The males swarm as with *excrucians* and *stimulans*, there being no differences in these habits between the three.

The winter is passed in the egg state, the larvae developing in early spring water, often with *excrucians*. The adults fly till late in the season, not entering houses.

Distribution.—Eastern forests to the Canadian Plains.

United States Records.

NEW HAMPSHIRE: Dublin (A. Busck).
MASSACHUSETTS: Mount Holyoke, April 15, 1905 (Dyar and Knab).
Longmeadow, April 16, 1905 (Dyar and Knab).
Springfield, May 17, 1905 (F. Knab).
NEW YORK: Plattsburgh, April 24, 1905 (H. G. Dyar).
Watkins, May 18, 1920 (H. G. Dyar).
WISCONSIN: Saxeville, May 22, 1909 (B. K. Miller).

AËDES (HETERONYCHA) MIMESIS Dyar.

Aëdes mimesis DYAR, Ins. Ins. Mens., vol. 5, p. 116, 1917.

A large blackish mosquito with ringed legs. Mesonotum light gray at the sides, a broad brown central band and short posterior side lines. Abdomen black above, with triangular segmental basal white spots, separated from the lateral spots in some cases; posterior segments white tipped also; venter white scaled with more or less of median narrow black line. Legs black, the femora and tibiae with many white scales, and pale beneath, tarsi black, with white rings at the bases of the joints, rather broad on the hind legs. Wing scales black, with many white ones intermixed on all the veins.

The larvae occur in marsh pools in the spring. This form is considered a race of *fitchii*, from which there are small larval differences.[15]

Distribution.—Rocky Mountain region, Montana to the Yukon Valley in Canada.

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[15] Dyar, Ins. Ins. Mens., vol. 8, p. 15, 1920.

United States Records.

MONTANA: Drummond, July 10, 1917 (H. G. Dyar).
Whitehall, July 11, 1917 (H. G. Dyar).
Bozeman, July 12, 1917 (H. G. Dyar).

AËDES (HETERONYCHA) PALUSTRIS Dyar.

Aëdes palustris DYAR, Ins. Ins. Mens., vol. 4, p. 89, 1916.
Aëdes palustris, var. *pricei* DYAR, Ins. Ins. Mens., vol. 5, p. 16, 1917.

A large blackish mosquito with ringed legs. Mesonotum gray at the sides, often intermixed with brown, a broad brown dorsal stripe and short posterior side stripes, not clearly marked. Abdomen black with basal segmental triangular spots, often separated from the lateral spots and sometimes joined into a longitudinal dorsal line (var. *pricei*); venter white, with broken narrow median black line. Legs black, with many white scales on femora, tibiae and first tarsal joint, the femora pale below; tarsi black, with white rings at the bases of the joints, broad on the hind legs. Wing scales black, with many white ones intermixed on all the veins.

The larvae live in early marsh pools. The form is considered a race of *fitchii*, the differences in larvae and male genitalia not being marked. The adults fly in forest till late summer.

Habitat.—Mountains of California and Oregon, coastal region of Pacific from Washington to Alaska where the land is not too precipitous.

United States Records.

CALIFORNIA: Yosemite, May 20, 1916 (H. G. Dyar).
Fallen Leaf Lake, June 24, 1916 (H. G. Dyar).
Tahoe City, June 17, 1920 (H. G. Dyar).
Truckee, June 21, 1920 (H. G. Dyar).
Summit, June 22, 1920 (H. G. Dyar).
Gold Lake Camp, July 21, 1916 (H. G. Dyar).
Camp Elwell, June 24, 1920 (H. G. Dyar).
OREGON: Crater Lake, July 30, 1920 (H. G. Dyar).
WASHINGTON: Lake Cushman, June 27, 1917 (H. G. Dyar).
ALASKA: Healy, June 24, 1921 (J. M. Aldrich).

AËDES (HETERONYCHA) RIPARIUS Dyar and Knab.

Aëdes riparius DYAR and KNAB, Journ. N. Y. Ent. Soc., vol. 15, p. 213, 1907.

A large yellowish mosquito. Mesonotum dark yellow on the sides, a broad brown band in the middle, contiguous to faint short posterior lateral stripes, the mesonotum more or less overspread with brown. Abdomen blackish, with yellowish diffuse basal segmental bands and scattering pale scales; venter yellowish, with black scales intermixed. Legs mostly yellow scaled, the tarsi black, with basal white rings on the joints, those on the hind legs large. Wings with the scales dark, many yellowish ones intermixed.

The larva is unknown and the habits of the males have not been observed. The adults occur in wooded prairie, but are so much like *flavescens* as to be indistinguishable without males. The species requires further study, although evidently distinct.

Distribution.—Canadian prairies, probably coëxtensive with *fletcheri*, but has not been differentiated. Probably extends into northern Minnesota, but collections are lacking that contain males.

United States Records.

None.

AËDES (HETERONYCHA) GROSSBECKI Dyar and Knab.

Aëdes grossbecki DYAR and KNAB, Journ. N. Y. Ent. Soc., vol. 14, p. 201, 1906.
Culex sylvicola GROSSBECK, Can. Ent., vol. 38, p. 129, 1906.

A large brownish-gray mosquito with ringed legs. Mesonotum whitish on the sides, with a dark brown central band, which widens out squarely posteriorly by junction with the posterior side stripes; a little brown also anteriorly on lateral angles of mesonotum. Abdomen black, with broad straight basal segmental white bands and scattered white scales, the last segment without basal band; some white scales apically on the terminal segments; venter whitish, with scattered black scales and traces of dark bands at the apices of the segments. Legs black with scattered white scales, the femora pale beneath; tarsi with white rings at the bases of the joints, broad on the hind legs. Wing scales broadly ovate, black and white rather evenly intermixed.

The larvae occur in spring in woods pools, often associated with *canadensis*. The species is rare and local, apparently on the verge of extinction.

Distribution.—Eastern United States, New Jersey to Mississippi.

United States Records.

NEW JERSEY: New Brunswick, May 17 (J. A. Grossbeck).
Livingston Park, May 5 (J. A. Grossbeck).
Elizabeth, May 28, 1906 (D. S. Carmody).
MARYLAND: Baltimore (T. H. Coffin).
VIRGINIA: Grassymead, June 19, 1906 (F. Knab).
MISSISSIPPI: Natchez, April, 1908 (A. Fleming).
Scott, April 24, 1915 (M. B. Mitzmain).

AËDES (HETERONYCHA) SQUAMIGER Coquillett.

Culex squamiger COQUILLETT, Proc. U. S. Nat. Mus., vol. 25, p. 85, 1902.
Grabhamia de niedmannii LUDLOW, Can. Ent., vol. 36, p. 234, 1904.

A rather large brownish-gray mosquito with ringed legs. Mesonotum largely suffused with dull brown, leaving a little gray about the margin and in two narrow posterior lines, confused, generally without definite pattern. Abdomen black, with many scattered white scales, the basal segmental bands widely triangular, separated from the lateral spots; white scales apically on the terminal segments; venter whitish, legs black, with pale scales intermixed; femora and tibiae pale below; tarsi with white rings at the bases of the joints, rather broad on the hind pair. Wing scales rather broadly ovate, black, with many white ones rather evenly intermixed.

The larvae inhabit salt marshes, in pools and narrow channels that are filled by the higher monthly tides. The adults frequent bushes in ravines near the shore. The species is extremely local and with very limited distribution. The marshes where it can breed are very few, and easily reclaimed, so that the species seems doomed with the advance of civilization. In certain localities the species has been occasionally numerous and troublesome.

Distribution.—Coast of California between San Francisco and San Diego, where marshes are formed at the outlets of rivers.

United States Records.

CALIFORNIA: Oakland, August 26, 1903 (I. McCracken).
Stanford University (V. L. Kellogg).
San Lorenzo, June 28, 1901 (G. Eisen).
Nordhoff, May 31, 1904 (A. D. Hopkins).
Hueneme, Ventura County, May 28, 1918 (F. M. Jones).
Laguna Beach (C. S. Baker).
San Diego, March 9, 1906 (J. M. French).
National City, June 19, 1906 (Dyar and Caudell).

Group THIBAULTI.

AËDES (HETERONYCHA) THIBAULTI Dyar and Knab.

Aëdes thibaulti DYAR and KNAB, Proc. Ent. Soc. Wash., vol. 11, p. 174, 1910.

A rather large blackish mosquito. Mesonotum grayish yellow on the sides, a moderately wide median dark brown band, which widens squarely posteriorly by fusion with the posterior side stripes. The marking is distinct and contrasted. Abdomen black above, with basal segmental triangular lateral white spots; venter whitish, with traces of black apical segmental bands, especially on the sides of the venter. Legs black, the femora white below; knee spots white. Wing scales all black, narrow.

The habits and life history are unknown, the species being so rare that they have not come under observation.

Distribution.—Gulf States.

United States Records.

ARKANSAS: Scott, April 27, 1909 (J. K. Thibault).
Cummins, May 8, 1915 (J. A. Le Prince).
Brinkley, May 3, 1915 (J. A. Le Prince).
Stuttgart, April 28, 1915 (J. A. Le Prince).
LOUISIANA: Mound, May 15, 1915 (D. L. Van Dine).
MISSOURI: Cypress Swamp, Mississippi County, June 15, 1918 (L. Haseman).

Group TRICHURUS.

AËDES (HETERONYCHA) TRICHURUS Dyar.

Culex trichurus DYAR, Journ. N. Y. Ent. Soc., vol. 12, p. 170, 1904.

A large dark-gray mosquito. Mesonotum gray on the sides, a dark brown band centrally joining the brown posterior lateral stripes, but these markings often diffused and not contrasted. Generally a small whitish space in front of the lateral stripes. Abdomen black, with broad basal segmental white bands, even; venter whitish-scaled. Legs black, the femora white towards base nearly to tip below. Wing scales black.

The winter is passed in the egg state, the larvae developing in the early ground-pools, in the forest. The male is unknown. The adults fly in woods, but disappear early in the season.

Distribution.—Western slope of Rocky Mountains in British Columbia and Montana.

United States Records.

MONTANA: Whitefish, June 16, 1921 (H. G. Dyar).
Belton. June 23, 1921 (H. G. Dyar.)

AËDES (HETERONYCHA) CINEREOBOREALIS Felt and Young.

Culex cinereoborealis FELT and YOUNG, Science, n. s., vol. 20, p. 312, 1904.
Aëdes poliochros DYAR, Ins. Ins. Mens., vol. 7, p. 35, 1919.

A large dark-gray mosquito. Mesonotum gray on the sides, with moderate central brown band, widening squarely behind from junction with the posterior lateral stripes. The marking is often faint or diffused. Abdomen black, with even basal segmental white bands, and a few scattered white scales, especially posteriorly; venter whitish. Legs black with some scattered scales, the femora whitish below. Wing scales all black.

The larvae occur in early spring pools in forest and leafy shaded ditches along roads. The mating habits of the males have not been observed. The adults disappear early in the season. The form is to be considered as a race of *trichurus*. There are slight larval differences, but the male genitalia have not been compared.

Distribution.—Southern fringe of the Canadian forest area, southern Canada, New England, New York and Minnesota.

United States Records.

NEW HAMPSHIRE: Dublin, May, 1909 (A. Busck).
Pike, May 25, 1908 (A. D. Hopkins).
MASSACHUSETTS: Chicopee, May 17, 1908 (A. D. Hopkins).
Springfield (G. Dimmock).

NEW YORK: Plattsburgh, April, 1905 (H. G. Dyar).
Karner, May 16, 1904 (E. P. Felt).
Ithaca, May 12, 1901 (O. A. Johannsen).
WISCONSIN: Saxeville, May 31, 1909 (B. K. Miller).

Group ALPINUS.

AËDES (HETERONYCHA) ALPINUS Linnaeus.

Culex alpinus LINNAEUS Flora Lapp., ed. 2, p. 381, 1792.
Culex nigripes ZETTERSTEDT, Ins. Lapp., p. 807, 1838.
Aëdes innuitus DYAR and KNAB, Ins. Ins. Mens., vol. 5, p. 166, 1917.
Aëdes n. sp. DYAR, Rept. Can. Arct. Exp., vol. 3, pt. C, p. 33, 1919.

A rather large black mosquito, with long hairy vestiture, especially conspicuous on under side of thorax. Mesonotum dark brown scaled, usually uniformly, a little lighter on the margins; setae long. Abdomen black, with broad basal segmental white bands; venter whitish scaled. Legs black, more or less sprinkled with white scales. The femora pale beneath. Wing scales black.

The larva develops in early summer in ground pools in the Arctic regions. The larva has the anal segment ringed, and detached teeth on the pecten of air tube, and is well figured by Wesenberg-Lund in his classical paper on Danish mosquitoes. The habits of the males are unknown.

Distribution.—Arctic Europe, Greenland, and North America.

United States Records.

ALASKA: Konganevik, Camden Bay, July 4, 1914 (F. Johannsen).
Collinson Point, July 22, 1914 (F. Johannsen).

AËDES (HETERONYCHA) NEARCTICUS Dyar.

Aëdes nearcticus DYAR, Rept. Can. Arct. Exp., vol. 3, pt. C, p. 32, 1919.
Aëdes (Ochlerotatus) parvulus EDWARDS, Bull. Ent. Res., vol. 3, p. 314, 1921.

A medium-sized black mosquito, much like *alpinus*, rather smaller, the legs less white speckled. The male genitalia differ in being less strongly chitinized, and the filament of the claspette has a broader expansion. The larvae have the pecten teeth of the air tube even, the anal segment not ringed.

The larvae develop in early summer in ground pools in the arctic regions. The habits of the males are unknown. This species flies with *alpinus*, both having a circumpolar distribution.

In both this species and *alpinus*, the basal lobe of the sidepiece of the male hypopygium is normally evenly haired, though sometimes the marginal hair is thickened into a distinct spine.

Distribution.—Arctic Europe and America.

United States Records.

ALASKA: Konganevik, Camden Bay, July 4, 1914 (F. Johannsen).

Subgenus TAENIORHYNCHUS Lynch Arribalzaga.[16]

AËDES (TAENIORHYNCHUS) ATROPALPUS Coquillett.

Culex atropalpus COQUILLETT, Can. Ent., vol. 34, p. 292, 1902.

A small blackish mosquito. Mesonotum silvery gray on the sides; a dark brown median band, joining the short posterior lateral bands. Abdomen black, with even basal segmental white bands; venter white scaled with black bands at the apices of the segments. Legs black, the femora whitish beneath; tips of femora and tibiae and tarsal joints at bases and apices narrowly white, the last hind tarsal all white. Wing scales all blackish.

The larvae live in holes in rocks along streams and the edges of lakes. The winter is passed in the egg state, the eggs fastened on the side of the rock. In summer generations the eggs are scattered loosely. The adults are good biters in the vicinity of their breeding places, which are necessarily very restricted, so that the species is never more than locally common. The mating habits of the males are unknown.

Distribution.—Atlantic coast region from Virginia to New England. Specimens from Saxeville, Wisconsin, reported in the monograph, are not this species but *canadensis*.

United States Records.

NEW HAMPSHIRE: Center Harbor, September 17, 1902 (H. G. Dyar).
White Mountains (H. K. Morrison).
MASSACHUSETTS: Cummington, July 5, 1903 (F. Knab).
Westfield, July 4, 1903 (F. Knab).
CONNECTICUT: Double Beach, July 21, 1904 (P. L. Butrick).
NEW YORK: Tupper Lake, August, 1904 (H. G. Dyar).
PENNSYLVANIA: Shenk's Ferry, October 21, 1901 (S. E. Weber).
MARYLAND: Great Falls, August 9, 1903 (F. C. Pratt).
Plummer Island, June 5, 1903 (W. V. Warner).
DISTRICT OF COLUMBIA: Chain Bridge, August 17, 1914 (H. G. Dyar).
VIRGINIA: Difficult Run, August 8, 1906 (Knab and Barber).
Richmond, October 26, 1901 (E. G. Williams).

AËDES (TAENIORHYNCHUS) EPACTIUS Dyar and Knab.

Aëdes epactius DYAR and KNAB, Proc. U. S. Nat. Mus., vol. 35, p. 53, 1908.

A small blackish mosquito. The markings and coloration are as in *atropalpus*, the lateral scales of the mesonotum somewhat whiter.

The larvae live in rock holes along streams. The form is doubtless to be considered a race of *atropalpus*.

Distribution.—Mexico and Arizona.

United States Records.

ARIZONA: Sabiño Basin, Catalina Mountains, August 23, 1918, larvae only (C. H. T. Townsend).

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[16] This subgeneric name becomes *Culiseta* Felt in case *Taeniorhynchus* is used to replace *Mansonia*.

AËDES (TAENIORHYNCHUS) VARIPALPUS Coquillett.

Culex varipalpus COQUILLETT, Can. Ent., vol. 34, p. 292, 1902.
Taeniorhynchus sierrensis LUDLOW, Can. Ent., vol. 37, p. 231, 1905.

A small blackish mosquito with white-ringed legs. Mesonotum dark brown, ornamented with a patch of light golden scales in front and a narrow line of the same from the lateral groove backward. Abdomen black, with basal segmental even white bands; venter whitish scaled. Legs black, the femora white below; tips of femora and tibiae and the apices of the tarsal joints silvery white, involving the bases of the joints to a less extent; rings narrow, except on the hind legs, where they are broad, involving the whole of the last joint. Wing scales wholly dark, thick and dense.

The larvae live in the water in holes in tree trunks, occasionally in artificial receptacles. The winter is passed in the egg state; it is not known whether there is more than one annual generation. The females occasionally occur in annoying numbers in old forests, but are usually rare. The males form little swarms in the daytime about some stationary warm-blooded animal, and mate with the females as these come to bite.

Distribution.—Pacific coast region from southern California to British Columbia.

United States Records.

ARIZONA: Sabino Basin, Catalina Mountains, August 28, 1918 (C. H. T. Townsend).
Williams, July 29 (H. S. Barber).
CALIFORNIA: Pasadena, May 11, 1906 (H. G. Dyar).
San Raphael, July 14, 1904 (E. H. Ashman).
Stanford University, July 7, 1908 (I. McCracken).
Orr's Hot Springs, Mendocino County, July, 1921 (D. Dyar).
Bair's Ranch, Humboldt County, June, 1903 (H. S. Barber).
Eureka, June 3, 1903 (H. S. Barber).
Fieldbrook, May 26, 1903 (H. S. Barber).
Dunsmuir, July 19, 1906 (A. N. Caudell).
Yosemite, May 16, 1916 (H. G. Dyar).
NEVADA: Glenbrook, August 25, 1915 (H. G. Dyar).
OREGON: Rockaway, Tillamook County, June 27, 1910 (L. P. Rockwood).
Portland (R. P. Currie).
Ashford, August 4, 1906 (Dyar and Caudell).
WASHINGTON: Kent, June 20, 1907 (H. E. Burke).
Seattle, July 31, 1906 (Dyar and Caudell).
Lake Cushman, July 4, 1920 (H. G. Dyar).

AËDES (TAENIORHYNCHUS) FLUVIATILIS Lutz.

Culex fluviatilis LUTZ in Bourroul, Mosq. do Brasil, pp. 42, 72, 1904.
Danielsia mediomaculata THEOBALD, Mon. Culic., vol. 4, p. 245, 1907.
Danielsia tripunctata THEOBALD, Mon. Culic., vol. 4, p. 247, 1907.
Aëdes lithœcetor DYAR and KNAB, Journ. N. Y. Ent. Soc., vol. 15, p. 201, 1907.
Aëdes zoösophus DYAR and KNAB, Ins. Ins. Mens., vol. 5, p. 165, 1918.

A medium-sized blackish mosquito with ringed legs and golden mesonotum. Mesonotum whitish golden on anterior half, this color also along the margins and antescutellar space behind, leaving a double brown patch on each side. Abdomen black above, with whitish basal segmental lateral spots and a more or less distinct dorsal row or broken pale line; venter whitish, the segments more or less, sometimes strongly, bordered with black at their apices. Legs black, the femora white beneath toward base; tarsi with moderate white rings at the bases of the joints, often slightly involving the tips also.

The larvae live in holes in rocks along streams which become water filled. The adults bite readily, but occur only in the vicinity of rocky streams. Our single United States example differs in some details from the tropically distributed form, and perhaps will have to be separated as race *zoösophus.*

Distribution.—Tropical America, from Brazil to Texas.

United States Records.

TEXAS: Kerrville, August 19, 1909 (F. C. Pratt).

AËDES (TAENIORHYNCHUS) TAENIORHYNCHUS Wiedemann.

Culex taeniorhynchus WIEDEMANN, Dipt. Exot., p. 43, 1821.
Culex damnosus SAY, Journ. Acad. Nat. Sci. Phila., vol. 3, p. 11, 1823.

A rather small blackish mosquito. Mesonotum dark brown, uniform. Abdomen black, with narrow basal segmental white bands, lateral spots white, those on the posterior segments about the middle of the segment and often visible in dorsal view; venter sordid yellowish, with dark bands at the apices of the segments. Legs black, the femora white beneath, tibiae somewhat sprinkled with pale scales; tarsi with narrow white rings at the bases of the joints, wider on the hind legs, the fifth hind tarsal all white or nearly so. Proboscis with a narrow white ring. Wing scales wholly blackish.

The larvae inhabit pools near the seacoast that are slightly saline, but not directly filled by tides. They sometimes occur in enormous numbers along the coast. This is the species which in Florida is said to turn a white horse black in an instant when one drives into cover. It is not as abundant as *sollicitans* on the north Atlantic coast.

Distribution.—Atlantic and Pacific coasts of America, from the Tropics to the lower temperate regions.

United States Records.

CONNECTICUT: East River, July 27, 1908 (C. R. Ely).
NEW YORK: Bellport, August, 1902 (H. G. Dyar).
Babylon, July 1, 2903 (W. W. Hewlett).
Sag Harbor, July 7, 1908 (C. E. Wells).

MARYLAND: Piney Point (T. Pergande).
Chesapeake Beach, August 21, 1906 (F. Knab).
VIRGINIA: Virginia Beach, September 20, 1911 (H. G. Dyar).
GEORGIA: Brunswick, May 21, 1915 (R. H. von Ezdorf).
SOUTH CAROLINA: Parr's Island, September, 1921 (J. C. Parham).
LOUISIANA: Ruddock, July 17, 1901 (———).
MISSISSIPPI: Ship Island, July 14, 1914 (R. H. von Ezdorf).
TEXAS: Victoria, May 5, 1904 (E. G. Hines).
Houston, July, 1921 (A. C. Chandler).
Cypress Bayou (J. D. Mitchell).
CALIFORNIA: San Diego, June 2, 1906 (Dyar and Caudell).
Carpinteria, July 2, 1906 (H. G. Dyar).

AËDES (TAENIORHYNCHUS) PORTORICENSIS Ludlow.

Taeniorhynchus niger GILES (not Theobald), Journ. Trop. Med., vol. 7, p. 382, 1904.
Culex portoricensis LUDLOW, Can. Ent., vol. 37, p. 386, 1905.

A rather small blakish mosquito. Differs from *taeniorhynchus* only in having the last hind tarsal joint strongly blackish tipped.

The habits are the same as those of *taeniorhynchus*, of which this is to be considered a local race.

Distribution.—Antilles and southern Florida.

United States Records.

FLORIDA: Osprey, August 31, 1901 (S. G. Webb).
Estero, July, 1907 (J. B. van Duzee).
Adam Key, March 21, 1917 (T. E. Snyder).
Tampa, March 18, 1905 (H. G. Dyar).
New Smyrna, March 21, 1905 (Dyar and Caudell).
Miami, March 12, 1905 (Dyar and Caudell).
Palm Beach (H. G. Dyar).
Biscayne Bay (A. T. Slosson).
Knights Key, December 2, 1908 (W. H. Sligh).
Key West, June 27, 1901 (C. N. Barney).
Loggerhead Key, Dry Tortugas, June 19, 1910 (A. G. Mayer).

AËDES (TAENIORHYNCHUS) NIGROMACULIS Ludlow.

Grabhamia nigromaculis LUDLOW, Geo. Wash. Univ. Bull., vol. 5, p. 85, 1907.
Grabhamia grisea LUDLOW, Can. Ent., vol. 39, p. 130, 1907.

A rather large blackish mosquito with ringed legs. Mesonotum bronzy yellow, a median dark-brown band and dark brown at the sides, the pleura white scaled. Abdomen black with basal segmental and median longitudinal bands of dull yellowish, the lateral spots prolonged and of about the same shade as the dorsal markings; venter sparsely dull yellowish scaled. Legs black; femora, tibiae, and first tarsal with many yellowish scales; femora sparsely black sprinkled below; tarsi black, with white rings at the bases of the joints, rather broad in the hind legs; knee spots white. Proboscis with a white ring. Wing scales black, a few whitish ones intermixed along the costa.

The winter is passed in the egg state, the larvae developing in early ground pools in dry country. In the presence of irrigation several generations, or hatchings, may occur in the season and the species become abundant. The females are severe biters. The males swarm after sunset over prominent objects on the prairie.

Distribution.—Dry valleys and plains from Mexico to Canada.

United States Records.

NEW MEXICO: Springer, August 25, 1909 (C. N. Ainslie).
Cimarron, September, 1909 (C. N. Ainslie).
Las Vegas Hot Springs, August 3 (H. S. Barber).
Koehler, July 20, 1913 (W. R. Walton).
COLORADO: Oxford, September 1, 1918 (I. M. Way).
Grand Junction, July 12, 1911 (G. P. Weldon).
Akron, June 24, 1909 (H. L. Shantz).
Boulder, September 2, 1907 (S. A. Rohwer).
TEXAS: Brownsville, August 28, 1916 (M. M. High).
Plano, November (E. S. Tucker).
MONTANA: Cascade, July 25, 1907 (W. E. Britton).
Laurel, July 16, 1917 (H. G. Dyar).
Whitehall, July 11, 1917 (H. G. Dyar).
Bozeman, July 12, 1917 (H. G. Dyar).
Bigtimber, August 25, 1908 (R. A. Cooley).
WYOMING: Basin, August 3, 1917 (W. V. King).
IDAHO: Boise, August 4, 1901 (C. B. Simpson).
NORTH DAKOTA: Devils Lake, July 20, 1921 (H. G. Dyar).
Grand Forks, July 21, 1921 (H. G. Dyar).
SOUTH DAKOTA: Brookings, summer, 1889 (J. M. Aldrich).

AËDES (TAENIORHYNCHUS) MITCHELLAE Dyar.

Culex mitchellae DYAR, Journ. N. Y. Ent. Soc., vol. 13, p. 74, 1905.

A medium-sized blackish-brown mosquito with ringed legs. Mesonotum rusty brown, darker on the sides and streaked with lighter centrally. Abdomen black, with yellowish-white basal segmental bands and median longitudinal stripe; venter gray, with black and white scales intermixed. Legs black, with many white scales intermixed, especially on femora and tibiae; femora pale below; tarsi with snowy white rings at the bases of the joints, the last joint all white. Wing scales entirely black. Probiscis with a white ring.

The larvae occur in early ground pools. The species is very seldom met with, and then in small numbers. The habits are unknown.

Distribution.—Southern States.

United States Records.

TEXAS: Victoria, April 5, 1919 (J. D. Mitchell).
ALABAMA: Mobile, March, 1905 (G. Dimmock).
FLORIDA: Kissimmee, March 19, 1905 (H. G. Dyar).
Green Cove Springs, March 4, 1905 (A. N. Caudell).
Magnolia Springs, March 8, 1905 (Dyar and Caudell).
Jacksonville, March 2, 1905 (Dyar and Caudell).
SOUTHERN GEORGIA: March 2, 1905 (Dyar and Caudell).

AËDES (TAENIORHYNCHUS) SOLLICITANS Walker.

Culex sollicitans WALKER, Ins. Saund., Dipt., p. 427, 1856.

A medium-sized blackish mosquito with ringed legs. Mesonotum bronzy yellow, dark brown at the sides, the pleura white scaled. Abdomen black, with basal and median longitudinal bands of pale yellow, the lateral spots, medianly on the segments, white; venter yellowish, with some black scales toward the tips of the segments. Proboscis with a white ring. Legs black, the femora yellowish below; knee spots white; tibiae with yellowish scales; tarsi black, the first tarsal with a yellowish central ring, the other joints white at base, broadly so on the hind pair. Wing scales black and white, evenly mixed.

The larvae live in salt tidal pools on the coast. The winter is passed in the egg state, and there are as many generations in the year as conditions permit. The adults are locally abundant, and in such cases travel many miles inland.

Distribution.—Coasts of Mexico, Gulf States, Antilles, Atlantic States to New England.

United States Records.

TEXAS: Sand Point, Matagorda Bay, July 30, 1901 (J. D. Mitchell).
Galveston, April 1, 1905 (J. C. Crawford).
Corpus Christi, March 22, 1905 (W. E. Hinds).
Victoria, June 13, 1904 (E. G. Hines).
Smith Point, November 7, 1918 (H. S. Barber).
LOUISIANA: Johnson's Bayou, July 26, 1906 (J. D. Mitchell).
New Iberia, October 15, 1904 (E. S. G. Titus).
MISSISSIPPI: Natchez, April, 1903 (A. Fleming).
Ocean Springs, November 22, 1902 (G. W. Herrick).
FLORIDA: St. Vincent Island, November 3, 1910 (W. L. McAtee).
Ramrod Key, November 7, 1918 (M. Kisliuk, jr.).
Palm Beach, March 14, 1905 (H. G. Dyar).
GEORGIA: Savannah, October 20, 1920 (S. F. Hildebrand).
SOUTH CAROLINA: McClellansville, October 11, 1906.
NORTH CAROLINA: Wilmington, July 22, 1918 (R. W. Leiby).
VIRGINIA: Paramore's Island, July 15, 1914 (H. G. Dyar).
MARYLAND: Piney Point, June 19, 1904 (T. Pergande).
DELAWARE: Rehoboth Beach, August 21, 1921 (H. G. Dyar).
NEW JERSEY: Cape May County, September 1, 1900 (B. I. Paschall).
PENNSYLVANIA: Philadelphia Neck, July 9 (H. Hornig).
NEW YORK: Bellport, August, 1901 (H. G. Dyar).
CONNECTICUT: East River, July 21, 1908 (C. R. Ely).
RHODE ISLAND: Weekapaug, July 20, 1904 (H. G. Dyar).
MASSACHUSETTS: Beverly, September 15, 1871 (E. Burgess).
NEW HAMPSHIRE: Durham, August 8 (H. G. Dyar).
MAINE: Lincolnville, August, 1908 (H. G. Dyar).

Subgenus FINLAYA Theobald.

AËDES (FINLAYA) TRISERIATUS Say.

Culex triseriatus SAY, Journ. Acad. Nat. Sci. Phila., vol. 3, p. 12, 1823.
Finlaya (?) *nigra* LUDLOW, Can. Ent., vol. 37, p. 387, 1905.
Aëdes triseriatus hendersoni COCKERELL, Journ. Econ. Ent., vol. 11, p. 199, 1918.

A medium sized black mosquito with spotted abdomen. Mesonotum dark brown in the middle, the sides silvery white. Abdomen black dorsally, with silvery white lateral basal segmental spots; venter white scaled, the posterior segments black-banded at apices. Legs deep black, the femora silvery white below. Wing scales black.

The larvae live in the water in the holes in tree trunks, the winter being passed in the egg state. The females are severe biters, and though never abundant, are often troublesome in dry woods. The habits of the male have not been observed.

Distribution.—United States from the Gulf of Mexico to Montana and New England.

United States Records.

NEW HAMPSHIRE: Center Harbor, June 24, 1902 (H. G. Dyar).
MASSACHUSETTS: West Springfield, August 16, 1903 (F. Knab).
East Lee, July 26, 1921 (J. L. Webb).
CONNECTICUT: Fairfield County, August, 1910 (V. Howard).
NEW YORK: Ithaca, July (O. A. Johannsen).
NEW JERSEY: Lahaway, June 6, 1908 (J. T. Brakeley).
DISTRICT OF COLUMBIA: Washington, September 11, 1903 (J. Kotinsky).
MARYLAND: Herzog's Island, June 24, 1906 (F. Knab).
VIRGINIA: Bluemont, June 20, 1904 (F. C. Pratt).
NORTH CAROLINA: Charlotte, May 30, 1916 (H. P. Barret).
SOUTH CAROLINA: Columbia, August 1, 1906 (———).
GEORGIA: Atlanta, May 11, 1900 (W. B. Summerall).
FLORIDA: New Smyrna, March 21, 1905 (Dyar and Caudell).
Miami, March 8, 1905 (Dyar and Caudell).
MISSISSIPPI: Jackson, August 8, 1904 (H. S. Barber).
LOUISIANA: Mound, April 27, 1915 (D. L. Van Dine).
TEXAS: Victoria, October 5, 1904 (E. G. Hines).
MISSOURI: St. Louis, September, 1904 (A. Busck).
KANSAS: Lawrence, May (H. T. Martin).
IOWA: Ames, August 17, 1906 (H. J. Quayle).
KENTUCKY: Corbin, August 24, 1904 (H. S. Barber).
ARKANSAS: Helena, July 30, 1904 (H. S. Barber).
TENNESSEE: Chattanooga, August 20, 1904 (H. S. Barber).
INDIAN TERRITORY: Wister, July 7, 1904 (H. S. Barber).
MONTANA: Missoula, July 6, 1917 (H. G. Dyar).

Subgenus ECCULEX Felt.

AËDES (ECCULEX) VEXANS Meigen.

Culex vexans MEIGEN, Syst. Beschr. Eur. zweifl. Ins., vol. 6, p. 241, 1820.
Culex articulatus RONDANI, Bull. Soc. Ent. Ital., vol. 4, p. 30, 1872.

Culex malariae Grassi, Rend. della R. Acad. dei Lincei, 1889.
Culex sylvestris Theobald, Mon. Culic., vol. 1, p. 406, 1901.
Culex nocturnus Theobald, Mon. Culic., vol. 3, p. 159, 1903.
Culex montcalmi Blanchard, Les Moust., p. 407, 1905.
Culicada nipponii Theobald, Mon. Culic., vol. 4, p. 337, 1907.
Culicada minuta Theobald, Mon. Culic., vol. 4, p. 338, 1907.
Culex stenoetrus Theobald, Mon. Culic., vol. 4, p. 395, 1907.
Culicada eruthrosops Theobald, Mon. Culic., vol. 5, p. 229, 1910.
Culex pseudostenoetrus Theobald, Mon. Culic., vol. 5, p. 343, 1910.
Aëdes euochrus Howard, Dyar, and Knab, Mosq. No. & Cent. Am. & W. I., vol. 4, p. 716, 1917.

A medium-sized to small brown mosquito. Mesonotum, a little paler about antescutellar space. Abdomen black, with narrow white basal segmental bands, tending to be notched on dorsal line; lateral spots separated therefrom, quadrate and elongate; venter whitish scaled, with more or less distinct median blackish spots. Legs black, femora pale below; tarsi with very narrow white rings at the bases of the joints. Wing scales wholly dark.

The winter is passed in the egg state, the larvae hatching in early ground pools, but also later in the season whenever the pools are filled by rain or otherwise. However, there may not be more than one annual generation. The females are severe biters in woods and thickets, not frequenting the open. The males swarm after sunset, sometimes in very large groups. This is the commonest woods mosquito throughout the country, but it does not extend to high altitudes or the forests of the Canadian zone.

Distribution.—North America, from the Mexican Plateau to Canada, except on the Pacific coast and far north; Europe, northern Asia.

United States Records.

New Hampshire: Center Harbor, August 22, 1902 (H. G. Dyar).
Massachusetts: Beverly, June 2, 1876 (E. Burgess).
Connecticut: Suffield (G. Dimmock).
New York: Tupper Lake, August 6, 1904 (H. G. Dyar).
New Jersey: Summit, May 17, 1901 (La Rue Holmes).
Maryland: Plummer Island, August 19, 1902 (H. S. Barber).
District of Columbia: Washington, August 17, 1900 (W. E. Hinds).
Virginia: Del Ray, June 8, 1903 (F. C. Pratt).
North Carolina: Charlotte, May 5, 1915 (H. P. Barret).
Georgia: Brunswick, March 6, 1911 (G. Coester).
Florida: West Tampa, March 18, 1905 (H. G. Dyar).
New Smyrna, March 21, 1905 (Dyar and Caudell).
Mississippi: Corinth, August 11, 1904 (H. S. Barber).
Louisiana: Baton Rouge, November, 1902 (H. A. Morgan).
Texas: Dallas, September 15, 1905 (F. C. Pratt).
Arkansas: Scott, August 23, 1909 (J. K. Thibault).
Tennessee: Rives, July 27, 1904 (H. S. Barber).
Missouri: St. Louis, September, 1904 (A. Busck).
Illinois: Urbana, September 2, 1904 (F. Knab).

INDIANA: Lafayette, July 27, 1916 (J. J. Davis).
OHIO: Toledo, June 23, 1915 (C. Fox).
KANSAS: Kansas City, August 2, 1909 (A. N. Caudell).
WEST VIRGINIA: White Sulphur Springs, September 24, 1915 (F. Knab).
COLORADO: Denver, July 28, 1906 (E. P. Taylor).
UTAH: Elsinore, August 6, 1907 (E. S. G. Titus).
IDAHO: Sandpoint, July 3, 1917 (H. G. Dyar).
MONTANA: Laurel, July 16, 1917 (H. G. Dyar).
MINNESOTA: Moorhead, July 27, 1921 (H. G. Dyar).
NORTH DAKOTA: Devils Lake, July 20, 1921 (H. G. Dyar).
NEW MEXICO: Pecos, June 26 (Grabham and Cockerell).
ARIZONA: Tacna, April 15 (H. G. Hubbard).
CALIFORNIA: Bakersfield, April 3, 1918 (H. E. Woodworth).
Yosemite, May 14, 1916 (H. G. Dyar).

Subgenus AËDES Meigen.

AËDES (AËDES) CINEREUS Meigen.

Aëdes cinereus MEIGEN, Syst. Beschr. Eur. zweifl. Ins., vol. 1, p. 13, 1918.
Culex nigritulus ZETTERSTEDT, Dipt. Scand., vol. 9, p. 3459, 1850.
Aëdes fuscus OSTEN SACKEN, Bull. U. S. Geog. Surv., vol. 3, p. 191, 1877.
Culex pallidohirta GROSSBECK, Can. Ent., vol. 37, p. 359, 1905.
Culex pallidocephala THEOBALD, Mon. Culic., vol. 5, p. 612, 1910.

A rather small blackish mosquito. Mesonotum dark brown. Abdomen black, with a continuous lateral white line, but also with this line broken into spots and with more or less distinct basal segmental white bands; venter whitish scaled. Legs black, the femora whitish beneath. Wing scales all dark. The male has short palpi as in the female and is easily recognized thereby.

The winter is passed in the egg state, the larvae developing in early spring pools, but also, following rains, during the summer. The later emergencies are less numerous. The females are good biters in woods and thickets, not coming into the open. The males swarm after sunset in openings between willows and similar locations.

Distribution.—Northern North America and northern Europe, along the southern part of the forests.

United States Records.

NEW HAMPSHIRE: Center Harbor, August 5, 1902 (H. G. Dyar).
Dublin, May (A. Busck).
MASSACHUSETTS: Springfield, May 10, 1903 (F. Knab).
CONNECTICUT: Hartford, April 12, 1905 (F. Knab).
NEW YORK: Plattsburgh, April 20, 1905 (H. G. Dyar).
Watkins, May 11, 1920 (H. G. Dyar).
NEW JERSEY: Delair, June 21 (J. B. Smith).
ARKANSAS: Scott, April 14, 1909 (J. K. Thibault).
WISCONSIN: Madison (S. J. Holmes).
MINNESOTA: Clear River, June 15, 1914 (C. W. Howard).

MONTANA: Drummond, July 10, 1917 (H. G. Dyar).
WASHINGTON: Glacier, June, 1917 (H. G. Dyar).
OREGON: Prospect, May 25, 1921 (H. G. Dyar).
CALIFORNIA: Lakes Center Camp, July 1, 1920 (H. G. Dyar).
Tahoe City, May, 1921 (H. G. Dyar).
Fallen Leaf, June 9, 1916 (H. G. Dyar).
Yosemite, May 17, 1916 (H. G. Dyar).

AËDES (AËDES) VENTROVITTIS Dyar.

Aëdes ventrovittis DYAR, Ins. Ins. Mens., vol. 4, p. 84, 1916.

A small black mosquito. Head with the vertex clothed with long narrow white scales and black cleft ones, flat scales only at the sides in the female; the male has conspicuous flat black and white scales, but a broad channel of narrow ones on the vertex. Mesonotum olive gray, with a variously extensive median brown area, or two diffused brown lines. Abdomen black, with narrow white basal segmental bands, cleft on dorsal line and sometimes reduced to lateral spots; venter pale, with black bands at the apices of the segments and a median black line. Legs black, some whitish scales intermixed, especially below; femora narrowly pale below. Wing scales black.

This species is addicted to high mountains, appears early in the season and is soon gone. The adult bites with ferocity by day in mountain meadows and woods. The larva and breeding habits are unknown.

Distribution.—High mountains of California and probably Washington, though the specimens from the latter locality are so much damaged that the identification is not certain.

United States Records.

CALIFORNIA: Fallen Leaf, June 15, 1916 (H. G. Dyar).
Tahoe City, June 18, 1920 (H. G. Dyar).
Gold Lake, July 4, 1916 (W. B. Herms).
Camp Elwell, June 23, 1920 (H. G. Dyar).
WASHINGTON: Mount Rainier, August 3, 1906 (Dyar and Caudell).

Subgenus STEGOMYIA Theobald.

AËDES (STEGOMYIA) AEGYPTI Linnaeus.

Culex aegypti LINNAEUS, Hasselq. Palestina Reise, p. 470, 1762.
Culex argenteus POIRET, Journ. de Phys., vol. 30, p. 245, 1787.
Culex fasciatus FABRICIUS (not Müller, not Meigen), Syst. Antliat., p. 36, 1805.
Culex calopus MEIGEN, Syst. Beschr. Eur. Zweifl. Ins., vol. 1, p. 3, 1818.
Culex mosquito ROBINEAU-DESVOIDY, Mem. Soc. Nat. Hist. Paris, vol. 3, p. 407, 1827.
Culex frater ROBINEAU-DESVOIDY, Mem. Soc. Nat. Hist. Paris, vol. 3, p. 408, 1827.
Culex taeniatus WIEDEMANN, Ausser, Zweifl. Ins., vol. 1, p. 10, 1828.
Culex kounoupi BRULLÉ, Exp. Sci. do Moree, Zool., vol. 3, p. 289, 1836.

Culex annulitarsis MACQUART, WEBB, and BERTH, Hist. Nat. Iles Can., p. 2, Ins. p. 99, 1839.
Culex viridifrons WALKER, List Dipt. Brit. Mus., vol. 1, p. 3, 1848.
Culex excitans WALKER, List Dipt. Brit Mus., vol. 1, p. 4, 1848.
Culex formosus WALKER, List Dipt. Brit. Mus., vol. 1, p. 4, 1848.
Culex inexorabilis WALKER, List Dipt. Brit. Mus., vol. 1, p. 4, 1848.
Culex exagitans WALKER, Ins. Saund., Dipt., p. 430, 1856.
Culex impatibilis WALKER, Proc. Linn. Soc., Zool., vol. 4, p. 91, 1860.
Culex zonatipes WALKER, Proc. Linn. Soc., Zool., vol. 5, p. 229, 1861.
Culex bancrofti SKUSE, Proc. Linn. Soc. N. S. W., ser. 2, vol. 3, p. 1740, 1889.
Culex elegans FICALBI, Bull. Soc. Ent. Ital., vol. 21, p. 95, 1889.
Culex rossii GILES, Journ. Trop. Med., vol. 2, p. 64, 1899.
Stegomyia fasciata luciensis THEOBALD, Mon. Culic., vol. 1, p. 297, 1901.
Stegomyia fasciata queenslandensis THEOBALD, Mon. Culic., vol. 1, p. 297, 1901.
Stegomyia nigeria THEOBALD, Mon. Culic., vol. 1, p. 303, 1901.
Stegomyia fasciata persistans BANKS, Phil. Journ. Sci., vol. 1, p. 996, 1906.
Culex anguste-alatus BECKER, Mitt. Zool. Mus., Berlin, vol. 4, p. 79, 1908.
Culex albopalposus BECKER, Mitt. Zool. Mus. Berlin, vol. 4, p. 80, 1908.
Stegomyia fasciata atritarsis EDWARDS, Bull. Ent. Res., vol. 10, p. 129, 1920.

A small blackish mosquito with ringed legs and a lyre-shaped silvery marking on the mesonotum. Mesonotum dark brown, with two more or less distinct narrow pale yellowish median lines, and an outer silvery line, curving outward about the anterior edge of the disk and broadened, continued behind narrowly and straight. Abdomen black, with narrow basal segmentals white bands, the apical segments silvery also at tip; lateral spots white, on the last segments visible dorsally; venter whitish, with black bands on the segments posteriorly. Legs black, the femora pale beneath and with a silvery line in front; knee spots white; tarsi with white rings at the bases of the joints, the last hind tarsal all white. Proboscis black. Tips of palpi and tori white. Silvery scales on the clypeus. Wing scales black.

The species is domesticated, seeking houses and breeding in artificial containers. The adults bite by day or artificial light and are quiet in darkness. The males will swarm about a person sitting in a shaded place, but can not bite. The females are the vector of yellow fever. The species can not withstand frost and develops best at a rather high temperature.

This is the only species of the subgenus *Stegomyia* occuring in America, and apparently so occurs from having been introduced by commerce. Other species of the subgenus occur in the tropics of the Old World.

Distribution.—Tropical regions throughout the world. In summer is often carried into temperate regions and can persist till frost.

United States Records.

DISTRICT OF COLUMBIA: Washington, July 3, 1901 (J. Carroll).
VIRGINIA: Norfolk (R. Blue).

SOUTH CAROLINA: Columbia, September 12, 1908 (W. H. Sligh).
GEORGIA: Thomasville, October, 1905 (W. W. Jarrell).
FLORIDA: Miami, November 7, 1921 (G. F. Moznette).
LOUISIANA: New Orlenas, September 21, 1900 (H. A. Veazie).
MISSISSIPPI: Belzona, August 5, 1904 (H. S. Barber).
ARKANSAS: Helena, July 30, 1904 (H. S. Barber).
TENNESSEE: Knoxville, August 28, 1901 (S. R. Miller).
TEXAS: Dallas, June 27, 1904 (H. S. Barber).
ALABAMA: Tuscumbia, August 15, 1904 (H. S. Barber).
KENTUCKY: Lexington, October 19, 1901 (A. M. Miller).

Genus ORTHOPODOMYIA Theobald.

Orthopodomyia THEOBALD, Entom., vol. 37, p. 236, 1904.
Bancroftia LUTZ in Bourroul, Mosq. do Brasil, p. 59, 1904.
Pneumaculex DYAR, Proc. Ent. Soc. Wash., vol. 7, p. 46, 1905.

A small genus of wide distribution, all the species addicted to water in tree holes and similar locations, and on account of this restricted breeding habit, all the species are rare. Many of the adults are handsomely ornamented. Only a single species occurs in the United States.

ORTHOPODOMYIA SIGNIFER Coquillett.

Culex signifer COQUILLETT, Can. Ent., vol. 28, p. 43, 1896.

A medium-sized to small blackish mosquito. Mesonotum dark brown, marked with bluish silvery lines as follows: A line on each side about the margin; two central lines, running three-quarters back; two short posterior lines a little outside these; two short divergent lines on antiscutellar space. Abdomen black, with diffused pale basal segmental bands, widening on the sides; ventral segments narrowly pale at their bases, black outwardly. Legs black with pale scales, the femora pale beneath; tarsi with white rings involving both ends of the joints, rather broad on the hind legs. Wing scales black and whitish mixed, forming a white patch at the end of the cell.

The larvae live in tree holes. The eggs are placed on the sides of the cavity and are covered with a membrane. The adults rest on the trunks of trees, and could formerly be caught in the parks of Washington; but of late years the attention given to the trees has destroyed most of the breeding places. This species is close to *Orthopodomyia pulchripalpis* Rondani (=*albionensis* MacGregor) of Europe; but that has the two lines on antescutellar space joined in front to the median lines, forming a closed loop.

Distribution.—Southern States.

United States Records.

NEW JERSEY: New Brunswick (J. B. Smith).
MARYLAND: River View, August, 1905 (T. Pergande).
DISTRICT OF COLUMBIA: Washington, October 12, 1903 (T. Pergande).

VIRGINIA: Bluemont, July 27, 1906 (F. C. Pratt).
NORTH CAROLINA: Charlotte, August 3, 1915 (H. P. Barret).
SOUTH CAROLINA: Columbia, August 1, 1906 (A. C. Moore).
GEORGIA: Savannah, October 15, 1920 (V. H. Bassett).
MISSISSIPPI: Electric Mills (J. A. Le Prince).
ARKANSAS: Scott, August 24, 1909 (J. K. Thibault).
MISSOURI: St. Louis, September, 1904 (A. Busck).
INDIAN TERRITORY: Fort Sill (Army Medical Museum).
TEXAS: Kerrville, June 9, 1906 (F. C. Pratt).

Genus URANOTAENIA Lynch Arribálzaga.

Uranotaenia LYNCH ARRIBÁLZAGA, Rev. Mus. de La Plata, vol. 1, p. 375, 1891.
Anisochelomyia THEOBALD, Entom., vol. 38, p. 52, 1905.
Pseuduranotaenia THEOBALD, Journ. Econ. Biol., vol. 1, p. 33, 1905.
Pseudoficalbia THEOBALD, Trans. Linn. Soc. London, Zool., vol. 15, p. 89, 1912.

A small genus, mainly of tropical distribution. The larvae live in ground pools, and have a superficial resemblance to *Anopheles*, from the elongated black head, and the habit of lying flat in the water, although the larvae are not surface feeders. The adults are ornamented with lines of metallic blue scales.

KEY TO THE UNITED STATES SPECIES OF URANOTAENIA.

1.	Legs with the tarsi all black	2.
	Legs with last joint of hind tarsi white	**lowii** Theobald.
2.	Mesonotum without median blue line	**anhydor** Dyar.
	Mesonotum with median blue line	3.
3.	Blue line ending at antescutellar area	**socialis** Theobald.
	Blue line running back to scutellum	**sapphirinus** Osten Sacken.

URANOTAENIA LOWII Theobald.

Uranotaenia lowii THEOBALD, Mon. Culic., vol. 2, p. 339, 1901.
Uranotaenia continentalis DYAR and KNAB, Journ. N. Y. Ent. Soc., vol. 14, p. 187, 1906.
Uranotaenia minuta THEOBALD, Mon. Culic., vol. 5, p. 508, 1910.

A very small blackish mosquito. Mesonotum yellowish on the sides, a straight brown stripe in the middle; a brown spot over the root of the wing; a short line of bluish silvery scales in front of the wing on each side; patches of bluish silvery scales on pleura. Abdomen black, with apical segmental lateral elongate patches of silvery scales. Legs black, the femora pale below; knee spots white, sometimes inconspicuous. Apex of third, fourth, and fifth hind tarsals white. Wing scales black, a line of blue ones at base, running onto base of fifth vein.

The larvae develop in small ground pools. The adult is very small, and is not certainly known to bite. Specimens are seldom seen unless bred.

Distribution.—Tropical America, the Antilles, and Gulf coast of North America.

United States Records.

LOUISIANA: Baton Rouge, October 23, 1904 (J. W. Dupree).
Jackson Barracks, August (M. P. Chamberlain).
FLORIDA: Miami, December 10, 1921 (G. F. Moznette).

URANOTAENIA SAPPHIRINUS Osten Sacken.

Aëdes sapphirinus OSTEN SACKEN, Trans. Amer. Ent. Soc., vol. 2, p. 47, 1868.

A small blackish mosquito. Mesonotum brown, thinly scaled, a narrow line of metallic blue scales to the scutellum; a lateral line on each side, running to the wing. Abdomen black above; venter grayish. Legs black, femora pale beneath; tips of femora and tibiae with a pearly-white spot. Wing scales dark, a line of blue ones on basal half of fifth vein.

The winter is probably passed in the adult state. Eggs are laid in boat-shaped masses floating on the water. The females are not troublesome. I have no certain records of the biting. The habits of the males are unknown. A rare species, seldom seen unless bred.

Distribution.—Eastern United States from the Gulf of Mexico to northern New England.

United States Records.

NEW HAMPSHIRE: Center Harbor, July 27, 1902 (H. G. Dyar).
NEW YORK: Ithaca, October 2, 1906 (O. A. Johannsen).
Bellport, September 2, 1901 (H. G. Dyar).
MARYLAND: Plummer Island, September 6, 1906 (F. Knab).
VIRGINIA: Arlington, August 26, 1917 (H. G. Dyar).
SOUTH CAROLINA: Parr Shoals, August 18, 1915 (T. H. D. Griffitts).
FLORIDA: Jacksonville, March 28, 1905 (Dyar and Caudell).
Miami, December 15, 1921 (G. F. Moznette).
OHIO: Toledo, June 24, 1913 (C. Fox).
ARKANSAS: Scott, August 24, 1909 (J. K. Thibault).
MISSISSIPPI: Agricultural College, September 11, 1905 (W. V. Reed).
LOUISIANA: Mound, June 14, 1913 (A. H. Jennings).

URANOTAENIA SOCIALIS Theobald.

Uranotaenia socialis THEOBALD, Mon. Culic., vol. 2, p. 340, 1901.
Uranotaenia coquilletti DYAR and KNAB, Journ. N. Y. Ent. Soc., vol. 14, p. 187, 1906.

A small blackish mosquito. Mesonotum brown, thinly clothed; a narrow blue line running back to antescutellar area; a line of blue scales in front of wing base; a blue patch on pleura. Abdomen black; often with a posterior white patch on fifth segment; venter grayish. Legs black, femora pale below; knee spot white, sometimes indistinct. Wing scales black; a silvery line at base and on base of fourth vein.

The larvae are said to occur in permanent pools, resting horizontally as usual in the genus. The adult differs from *sapphirinus* only in the short interruption of the blue line across antescutellar space. The Jamaican specimens are so marked; but others from St. Thomas and Cuba have the line continuous. It is probably a local form of *sapphirinus* confined to Jamaica. The reported occurrance in Louisiana needs verification. No material is before me.

Distribution.—Island of Jamaica and Louisiana.

United States Records.

LOUISIANA: Baton Rouge (J. W. Dupree). (No material before me.)

URANOTAENIA ANHYDOR Dyar.

Uranotaenia anhydor DYAR, Proc. U. S. Nat. Mus., vol. 32, p. 128, 1907.

A small brown mosquito. Mesonotum brown, thinly clothed; a broken indistinct blue line along margin before wing insertion. Abdomen black; venter grayish. Legs black, knee spots narrowly white, femora pale below. Wing scales black, without silvery line.

The larvae live in permanent ponds, occurring only in the spring. The adults have never been taken except those bred. The species is rare.

Distribution.—Southern California.

United States Records.

CALIFORNIA: Sweetwater Junction, June 2, 1906 (Dyar and Caudell).
San Diego, May 11, 1916 (H. G. Dyar).

Genus MEGARHINUS Robineau-Desvoidy.

Megarhinus ROBINEAU-DESVOIDY, Mem. Soc. d'Hist. Nat., Paris, vol. 3, p. 403, 1827.

Megarhina MACQUART, Dipt. Ecot., vol. 1, pl. 1, p. 32, 1838.

Toxorhynchites HOWARD, Mosq., pp. 155, 235, 240, 1901.

Ankylorhynchus LUTZ in Bourroul, Mosq. do Brasil, p. 53, 1904.

Lynchiella LAHILLE, Act. y Trab. 2 Cong. Med. Lat.-Amer., vol. 2, p. 13, 1904.

Worcesteria BANKS, Phil. Journ. Sci., vol. 1, p. 779, 1906.

A genus of large showy insects of tropical and subtropical distribution. The adults do not bite, the proboscis being curved and adapted to extract honey from flowers. The larvae feed entirely on other mosquito larvae which occur in tree holes and similar locations. The species of this genus should be classed as strictly beneficial to man. On account of the restricted habits the species are rare.

The genus has been divided into three subgenera on the structure of the palpi. The United States species belong to *Megarhinus* proper.

KEY TO THE UNITED STATES SPECIES OF MEGARHINUS.

1. Male with white on front tarsi; female with joints 2, 3, 4 of front and mid tarsi white marked .... **rutila** Coquillett.
   Male with no white on front tarsi; female with joints 2, 3 of front and mid tarsi white marked .... **septentrionalis** Dyar and Knab.

MEGARHINUS RUTILA Coquillett.

Megarhinus rutila COQUILLETT, Can. Ent., vol. 28, p. 44, 1896.

A very large mosquito with bent proboscis, metallic green and yellow. Mesonotum dark brown, with a border of light green scales and a line through the center. Abdomen metallic green or blue with a broad white stripe along the sides. Palpi of the female three-quarters as long as the proboscis, of the male longer, the last joint long and acuminate. Legs black with blue reflection, brassy yellow below, knee spots white; tarsi of the female on front and middle legs with apex of first joint and all of second, third, and fourth white, hind legs with apex of third, fourth, and all but tip of fifth white; in the male, front and middle legs with second joint and basal two-thirds of third white, hind legs with fourth and basal two-thirds of fifth white. Wings smoky, the scales dark.

The life history and habits are unknown and the larva is undescribed. The species is very rare and females very difficult to distinguish from the following better known species.

Distribution.—Florida and extreme south.

United States Records.

FLORIDA: Georgiana (W. Wittfeld).
ALABAMA: Empire, August, 1913 (W. S. Sowell((female only).
MISSISSIPPI: Sibley (A. Fleming) (female only).

MEGARHINUS SEPTENTRIONALIS Dyar and Knab.

Megarhinus septentrionalis DYAR and KNAB, Smith. Misc. Colls., Quart. Iss., vol. 48, p. 247, 1906.
Megarhinus herrickii THEOBALD, Entom., vol. 39, p. 241, 1906.

A very large mosquito with bent proboscis, metallic green and yellow. Mesonotum dark brown, with a border of light green scales and a line through the center. Abdomen metallic green or blue with a broad white stripe along the sides. Palpi of the female three-quarters as long as the proboscis, of the male longer, the last joint long and acuminate. Legs black with blue reflection, brassy yellow below; knee spots white; tarsi of the female of front and mid legs with second and third and all but apex of fourth joints white, hind tarsi with extreme apex of third, all of fourth, and all but tip of fifth white; in male mid tarsi with second and basal two-thirds of the third joint white on outer side, hind legs with fourth joint entirely white, and base of fifth. Wings smoky brown, the scales black.

The larvae live in the water in holes in trees and feed exclusively upon other mosquito larvae, namely, *Aëdes triseriatus*, *Orthopodomyia signifer*, and perhaps *Anopheles barberi*. The females frequent flowers and suck honey. The males rest on the leaves of a selected plant, such as a poison ivy vine on a tree, forming a stationary swarm. Both sexes are active in bright daylight.

Distribution.—Southern States.

United States Records.

MARYLAND: Plummer Island, June 24, 196 (A. K. Fisher).
DISTRICT OF COLUMBIA: Washington, September 9, 1901 (J. Kotinsky).
VIRGINIA: Great Falls, September 17, 1906 (T. Pergande).
Skyland (W. Pollock).
WEST VIRGINIA: Morgantown, June 10, 1898 (A. D. Hopkins).
NORTH CAROLINA: Hartsville (J. L. Coker).
GEORGIA: Augusta, September 10, 1909 (W. V. Reed).
TENNESSEE: Knoxville, April 13, 1907 (Morgan and Cotton).
MISSOURI: St. Louis, October 4, 1904 (A. Busck).
ARKANSAS: Scott, July 24, 1908 (J. K. Thibault).
INDIAN TERRITORY: Ringo, (A. N. Caudell).
MISSISSIPPI: Agricultural College, September 26, 1905 (W. V. Reed).
LOUISIANA: Baton Rouge (J. W. Dupree).
TEXAS: Dallas, August 13, 1906 (Crawford and Pratt).

Genus ANOPHELES Meigen.

Anopheles MEIGEN, Syst. Beschr. Eur. Zweifl. Ins., vol. 1, p. 10, 1818.
Cyclolepppteron THEOBALD, Mon. Culic., vol. 1, p. 205, 1901.
Cyclolepidopteron BLANCHARD, C. R. Soc. Biol., vol. 53, p. 1046, 1901.
Grassia THEOBALD (not Fisch), Journ. Trop. Med., vol. 5, p. 181, 1902.
Myzomyia BLANCHARD, C. R. Soc. Biol., vol. 54, p. 795, 1902.
Stethomyia THEOBALD, Journ. Trop. Med., vol. 5, p. 182, 1902.
Howardia THEOBALD (not Dalla Torre), Journ. Trop. Med., vol. 5, p. 182, 1902.
Pyretophorus BLANCHARD, C. R. Soc. Biol., vol. 54, p. 795, 1902.
Rossia THEOBALD (not Bonaparte, not Owen), Journ. Trop. Med., vol. 5, p. 183, 1902.
Myzorhynchus BLANCHARD, C. R. Soc. Biol., vol. 54, p. 795, 1902.
Laverania THEOBALD (not Grassi and Feletti), Journ. Trop. Med., vol. 5, p. 183, 1902.
Nyssorhynchus BLANCHARD, C. R. Soc. Biol., vol. 54, p. 795, 1902.
Cellia THEOBALD, Journ. Trop. Med., vol. 5, p. 183, 1902.
Arribalzagia THEOBALD, Mon. Culic., vol. 3, p. 81, 1903.
Aldrichia THEOBALD, Mon. Culic., vol. 3, p. 358, 1903.
Lophoscelomyia, THEOBALD, Entom., vol. 37, p. 12, 1904.
Lophomyia GILES, Journ. Trop. Med., vol. 7, p. 366, 1904.
Kerteszia THEOBALD, Ann. Mus. Nat. Hung., vol. 53, p. 66, 1905.
Nototricha COQUILLETT, U. S. Dept. Agr., Bur. Ent., Tech. Ser., vol. 11, p. 13, 1906.
Coelodiazesis DYAR and KNAB, Journ. N. Y. Ent. Soc., vol. 14, p. 177, 1906.
Feltinella THEOBALD, Mon. Culic., vol. 4, p. 56, 1907.
Myzorhynchella THEOBALD, Mon. Culic., vol. 4, p. 78, 1907.
Manguinhosia CRUZ, Um. Nov. Gen. Braz. s.-f. Anoph., 1907.
Neocellia ROTHWELL, Entom., vol. 40, p. 34, 1907.
Neocellia THEOBALD (not Rothwell), Mon. Culic., vol. 4, p. 111, 1907.

Pseudomyzomyia THEOBALD, Mon. Culic., vol. 4, insert slip. 1907.
Calvertia LUDLOW (not Warren), Can. Ent., vol. 41, p. 22, 1909.
Calvertina LUDLOW, Can. Ent., vol. 41, p. 234, 1909.
Neomyzomyia THEOBALD, Mon. Culic., vol. 5, p. 29, 1910.
Aldrichinella THEOBALD, Mon. Culic., vol. 5, p. 77, 1910.
Christophersia JAMES, Paludism, vol. 1, p. 33, 1910.
Nyssomyzomyia JAMES, Paludism, vol. 1, p. 37, 1910.
Neostethopheles JAMES, Rec. Ind. Mus., vol. 4, p. 98, 1910.
Patagiamyia JAMES, Rec. Ind. Mus., vol. 4, p. 98, 1910.
Dactylomyia NEWSTEAD and CARTER, Ann. Trop. Med. & Par., vol. 4, p. 377, 1910.
Proterorhynchus BRÈTHES, Bol. Ins. Et. y Pat. Veg., vol. 1, p. 14, 1912.
Cyclophorus EYSELL, Arch. f. Schiffs.- u. Trop. Hyg., vol. 16, p. 421, 1912.
Dendropaedium DYAR and KNAB, Ins. Ins. Mens., vol. 6, p. 141, 1918.

A genus of world-wide distribution, especially in tropical and warm temperate regions, rare or absent in the North. The larvae are surface feeders, occurring mostly in ground pools of a permanent character, some in running water, and a few species restricted to tree holes or leaves of Bromeliaceae. The larvae are easily told by the short air tube. They lie attached to the surface film. The adults fly principally in the dusk. Some species freely enter houses. The hibernation is as adult. Most of the species of *Anopheles* transmit malaria, and are consequently of great economic importance.

The following subgenera, based on characters of the male genitalia, are suggested for the United States species:

1. Aedoeagus slender, with spines at tip ---------- Subgenus **Anopheles** Meigen.
Aedoeagus without spines at tip ---------- 2.
2. Aedoeagus broad, irregular, within a very large conical membrane with wrinkled walls ---------- Subgenus **Nyssorhynchus** Blanchard.
Aedoeagus small, slender, free ---------- 3.
3. Basal lobe conical with three setae ---------- Subgenus **Proterorhynchus** Brèthes.
Basal lobe elliptical with tuft of long flat hairs.
Subgenus **Coelodiazesis** Dyar and Knab.

KEY TO THE UNITED STATES SPECIES OF ANOPHELES.

1. Tarsi marked with white ---------- **albimanus** Wiedemann.
Tarsi without white markings ---------- 2.
2. Wings with white spots ---------- 3.
Wings with black spots or none ---------- 5.
3. Wings with a white spot at outer third costa ---------- 4.
Wings without this spot ---------- **crucians** Wiedemann.
4. Palpi marked with white; third vein extensively white in the middle.
pseudopunctipennis Theobald.
Palpi wholly black; third vein wholly black ---------- **punctipennis** Say.
5. Wings with black spots, usually distinct ---------- 6.
Wings with indistinct black spots or none, usualy absent ---------- 7.
6. Wing with a coppery spot at apex on fringe ---------- **maculipennis** Meigen.
Wing-fringe black at apex as elsewhere ---------- **quadrimaculatus** Say.
7. Mesonotum rounded, but little elongate ---------- **barberi** Coquillett.
Mesonotum distinctly elongate ---------- 8.

8. Palpi of female with whitish rings at bases of joints......**walkeri** Theobald.
Without distinct white rings on palpi; body blackish; hairs of mesonotum dark brown................................**atropos** Dyar and Knab.

Subgenus NYSSORHYNCHUS Blanchard.

ANOPHELES (NYSSORHYNCHUS) ALBIMANUS Wiedemann.

Anopheles albimanus WIEDEMANN, Dipt. Exot., p. 10, 1821.
Anopheles cubensis AGRAMONTE, El Prog. Med., Trop., vol. 1, p. 17, 1900.
Anopheles argyrotarsis albipes THEOBALD, Mon. Culic., vol. 1, p. 125, 1901.
Anopheles dubius BLANCHARD, Les Moust., p. 205, 1905.
Anopheles tarsimaculata GOELDI, Os Mosq. no Pará, p. 133, 1905.
Anopheles gorgasi DYAR and KNAB, Journ. N. Y. Ent. Soc., vol. 15, p. 198, 1907.

A medium-sized black *Anopheles*, the tip of hind tarsi white with a black spot on last joint. Mesonotum shining gray, a small black spot on each side and a larger one at posterior end. Abdomen dark gray, the segments with lateral projecting tufts of scales. Legs blackish, the fore tarsi with white rings at apices of the first three joints; hind legs with apex of second, third to fifth joints white, a black mark on the fifth joint. Wings with black and yellowish scales, two large yellowish spots outwardly on costa; other veins with small dark spots alternating with pale scales. Palpi long, dark, last joint and base of penultimate one white. Sometimes the last two joints of palpi wholly white or nearly so (*tarsimaculata*).

The larvae prefer stagnant water, exposed to the sun, with growth of algae. They occur readily in water of artificial production and readily associate with habitations. This is the principal vector of malaria in tropical America.

Distribution.—Tropical America, the Antilles, southern Florida. The forms *albimanus* and *tarsimaculata* have not the same distribution; but they intermix in Panama and elsewhere, and probably represent races of one species.

United States Records.

FLORIDA: Key West (C. H. Gardner).

Subgenus ANOPHELES Meigen.

ANOPHELES (ANOPHELES) PUNCTIPENNIS Say.

Culex punctipennis SAY, Journ. Acad. Nat. Sci. Phila., vol. 3, p. 9, 1823.
Culex hyemalis FITCH, Amer. Journ. Agr. Sci., vol. 5, p. 281, 1847.
Anopheles perplexens LUDLOW, Can. Ent., vol. 39, p. 267, 1907.

Mesonotum elongate, hairy, broadly whitish in the integument in the middle, dark brown on the sides. Abdomen hairy, brown, the apices of the segments darker, in the integument. Legs long and slender, blackish; tips of femora and tibiae with small white spots.

Wings with scales black except in certain spots as follows: A large one at outer third of costa and a smaller one at apex, both involving second vein; one on third vein in the cell, on the stem and middle of both forks; at base and middle of fifth vein.

The larvae are surface feeders in all sorts of water puddles, often in small or temporary rain puddles, but also in permanent water. The males swarm after sunset. A dangerous malaria carrier.

Distribution.—United States from Mexico northward, except the dry central region, reaching Canada at both coasts.

United States Records.

MAINE, Weld, August, 1910 (H. G. Dyar).
NEW HAMPSHIRE: Center Harbor, July 17, 1902 (H. G. Dyar).
NEW YORK: Plattsburg, August 9, 1901 (H. G. Dyar).
MASSACHUSETTS: West Springfield, May 14, 1903 (F. Knab).
PENNSYLVANIA: West Fairview, August 18, 1900 (H. G. Bashore).
NEW JERSEY: Delair, August 20, 1901 (W. P. Seal).
MARYLAND: Jackson's Island, July 29 (H. S. Barber).
WEST VIRGINIA: Huntington, November 11, 1902 (A. D. Hopkins).
VIRGINIA: St. Elmo, May 12 (F. C. Pratt).
GEORGIA: Atlanta, September 5, 1902 (C. A. Smith).
MISSISSIPPI: Corinth, August 14, 1904 (H. S. Barber).
ARKANSAS: Scott, September 24, 1909 (J. K. Thibault, jr.).
ILLINOIS: Urbana, August 8, 1904 (F. Knab).
KENTUCKY: Corbin, August 29, 1904 (H. S. Barber).
KANSAS: Onaga, October 8 (F. F. Crevecoeur).
TEXAS: Paris, April 26, 1904 (C. T. Brues).
CALIFORNIA: Sweetwater Junction, June 2, 1906 (Dyar and Caudell).
Stanford University, (I. McCracken).
OREGON: Portland, July 30, 1906 (Dyar and Caudell).
WASHINGTON: Ashford, August 5, 1906 (Dyar and Caudell).

ANOPHELES (ANOPHELES) QUADRIMACULATUS Say.

Anopheles quadrimaculatus SAY, Keat. Narr. Exp. St. Peter's Riv., vol. 2, p. 356, 1824.

Anopheles guttulatus HARRIS, Hitch. Rep. Geol. Min. Bot. Zool. Mass., p. 595, 1836.

Anopheles annulimanus VAN DER WULP, Tidj. voor Ent., vol. 10, p. 129, 1867.

A medium-sized blackish *Anopheles* with black-spotted wings. Mesonotum elongate, hairy, broadly whitish in the integument in the middle, dark brown on the sides. Abdomen with light hairs, brown, the apices of the segments darker, in the integument. Legs long and slender, blackish; tips of femora and tibiae whitish. Wings with the scales black, forming four dark spots by being thickly placed as follows: Base of second vein in the cell; on the cross veins and forks of second and fourth veins.

The larvae are surface feeders in water puddles, especially permanent water connected with rivers. The habits of the males have not been observed. A dangerous malaria carrier, permitting the evolution of all three species.

Distribution.—Mexico to New England, east of the Rocky Mountains.

United States Records.

NEW HAMPSHIRE: Berlin Falls, August 9, 1868 (F. G. Sanborn).
MASSACHUSETTS: Westfield, August 23, 1903 (F. Knab).
CONNECTICUT: Pine Orchard, July 19, 1903 (F. H. Hart).
NEW YORK: Bellport, August 27, 1901 (H. G. Dyar).
PENNSYLVANIA: West Fairview, August 18, 1900 (G. B. Bashore).
MARYLAND: Chesapeake Beach, July 4, 1903 (A. Busck).
VIRGINIA: St. Elmo, May (F. C. Pratt).
FLORIDA: Lake Okeechobee, March, 1906 (J. H. Egbert).
MISSISSIPPI: Belzona, August 5, 1904 (H. S. Barber).
TENNESSEE: Rives, July 27, 1904 (H. S. Barber).
LOUISIANA: New Orleans, May, 1904 (H. S. Barber).
TEXAS: Dallas, September 14, 1905 (C. E. Riggs).
COLORADO: Hotchkiss, August 20, 1911 (G. P. Weldon).
UTAH: Logan, October 15, 1913 (C. T. Vorhies).
ARKANSAS: Little Rock, July 11, 1904 (H. S. Barber).
MISSOURI: St. Louis, June, 1904 (A. Busck).
INDIANA: Lake Maxinkuckee (W. B. Evermann).
WISCONSIN: Saxeville, June 17, 1909 (B. K. Miller).

ANOPHELES (ANOPHELES) MACULIPENNIS Meigen.

Anopheles maculipennis MEIGEN, Syst. Beschr. Zweifl. Ins., vol. 1, p. 11, 1818.
Anopheles occidentalis DYAR and KNAB, Proc. Biol. Soc. Wash., vol. 19, p. 159, 1906.
Anopheles lewisi LUDLOW, Psyche, vol. 27, p. 74, 1920.
Anopheles selengensis LUDLOW, Psyche, vol. 27, p. 77, 1920.

A medium-sized blackish *Anopheles* with black-spotted wings. Mesonotum elongate, hairy, broadly whitish in the integument in the middle, dark brown on the side. Abdomen with light hairs, brown, the apices of the segments darker in the integument. Legs long and slender, blackish; tips of femora and tibiae whitish. Wings with the scales black, forming four dark spots by being thickly placed as follows: base of second vein in the cell; on the cross veins and forks of second and fourth veins. Tip of the wing with a brassy reflection in the fringe.

The larvae are surface feeders in all sorts of water puddles, preferring permanent water. The habits of the males have not been observed in America. The difference between this and *quadrimaculatus* is slight in coloration, but the male genitalia show good characters. This form has lately been shown to be identical with *maculipennis* Meigen, of Europe. It is evidently a good malaria carrier, although there is no record of experiments carried on with this form under the American name *occidentalis*.

Distribution.—Western United States except the moist northern Pacific strip, eastward through Canada to northern Maine; Europe and Asia.

United States Records.

CALIFORNIA: Sweetwater Junction, June 12, 1906 (Dyar and Caudell).
Fresno, April 4 (E. A. Schwarz).
Sisson, July, 1906 (Dyar and Caudell).
OREGON: Klamath Falls, July 27, 1906 (Dyar and Caudell).
NEVADA: Steamboat Springs, August 19, 1915 (H. G. Dyar).
UTAH: Lehi, September 8, 1905 (W. A. Hooker).
ALASKA: Fort Gibbon, June 6, 1907 (Army Medical Museum).
MAINE: Weld, July 25, 1910 (H. G. Dyar).
Norcross, July, 1914 (Z. P. Dyar).

ANOPHELES (ANOPHELES) WALKERI Theobald.

Anopheles walkeri THEOBALD, Mon. Culic., vol. 1, p. 199, 1901.

A medium-sized blackish *Anopheles*, without conspicuous wing spots. Palpi with small white rings at the bases of the joints. Mesonotum dark brown, uniformly colored. Abdomen blackish, with brown hairs. Legs long and slender, black, the femora pale below; small white spots at tips of femora and tibiae. Wing scales black, not forming distinct spots, though sometimes slight ones at the bases and forks of second and fourth veins.

The larvae inhabit water formed by overflows from rivers, which occasionally go dry. The habits of the males are unknown. It has not been demonstrated whether this species carries malaria.

Distribution.—Eastern North America.

United States Records.

MICHIGAN: Camp Custer, Battle Creek (Army Medical Museum).
MASSACHUSETTS: Westfield, August 23, 1903 (F. Knab).
DISTRICT OF COLUMBIA: Washington, June 10, 1911 (F. Knab).
Chain Bridge, October 15, 1906 (T. Pergande).
VIRGINIA: Addison, November 7, 1909 (A. N. Caudell).
Long Bridge, September 12, 1916 (A. H. Jennings).
ARKANSAS: Little Rock (J. K. Thibault).
LOUISIANA: Terrebonne, March 29, 1901 (G. E. Beyer).

ANOPHELES (ANOPHELES) ATROPOS Dyar and Knab.

Anopheles atropos DYAR and KNAB, Proc. Biol. Soc. Wash., vol. 19, p. 160, 1906.

A rather small blackish *Anopheles* with unspotted wings. Mesonotum elongate, deep brown. Abdomen blackish in the integument, with dark hairs. Legs and palpi entirely dark, the latter with traces of paler markings at the articulations. Wing scales entirely dark, not forming spots.

Little is known of this form, and nothing of the male or life history. Specimens were taken by Dr. M. J. White biting between four and five in the morning. Malaria relation unknown.

Distribution.—Coasts of Florida and Louisiana.

United States Records.

FLORIDA KEYS (H. Byrd).
LOUISIANA: Buras, July 17, 1918 (M. J. White).

ANOPHELES (ANOPHELES) CRUCIANS Wiedemann.

Anopheles crucians WIEDEMANN, Ausser. Zweifl. Ins., vol. 1, p. 12, 1828.

A medium-sized blackish *Anopheles* with mottled wings. Mesonotum grayish, with traces of dark spots, one especially on scutellum seen in oblique light. Abdomen blackish, with light brown hairs. Legs black with pale knee spots. Wings with a small yellowish white spot at apex and fringe; other scales mostly black, forming spots at the bases of the forked cells and three on the sixth vein, separated by pale scales. The palpi of the female have the last joint whitish and a ring at base of penumtimate joint.

The larvae live in ground pools, especially near the coast. The adults are very fond of entering dwellings. The species is a dangerous carrier of malaria.

Distribution.—Southeastern United States from New York to Mexico; Cuba and Jamaica.

United States Records.

NEW YORK: Bellport, October 13, 1901 (H. G. Dyar).
MARYLAND: Chesapeake Beach, July 4, 1903 (A. Busck).
DISTRICT OF COLUMBIA: April 27, 1893 (T. Pergande).
VIRGINIA: Lake Drummond, October 29, 1906 (H. S. Barber).
NORTH CAROLINA: Hendersonville, March 24, 1913 (W. B. W. Howe).
SOUTH CAROLINA: Columbia, September 12 (W. H. Sligh).
GEORGIA: Waycross, August 30, 1916 (R. H. von Ezdorf).
FLORIDA: Miami, November 11, 1921 (G. F. Moznette).
MISSISSIPPI: Biloxi, December 6, 1902 (J. Brodie).
LOUISIANA: New Orleans, June 28, 1900 (H. A. Veazie).
TEXAS: Galveston, September 30, 1901 (I. T. Moore).

Subgenus PROTERORHYNCHUS Brèthes.

ANOPHELES (PROTERORHYNCHUS) PSEUDOPUNCTIPENNIS Theobald.

Anopheles pseudopunctipennis THEOBALD, Mon. Culic., vol. 2, p. 305, 1901.
Anopheles franciscanus MCCRACKEN, Ent. News, vol. 15, p. 12, 1904.
Anopheles peruvianus TAMAYO AND GARCIA, Los Ag. de Huac., Mem. Munc. Lima, App., p. 35, 1907.
Proterorhynchus argentinus BRÈTHES, Bol. Inst. Ent. y Pat. Veg., vol. 1, p. 15, 1912.
Anopheles tucumanus LAHILLE, An. Mus. Nat. B. A., vol. 23. p. 253, 1912.

A medium-sized blackish *Anopheles* with white-spotted wings. Mesonotum broadly whitish in the middle, dark brown on the sides. Abdomen gray, with pale hairs. Legs black, knee spots yellowish white. Wings spotted black and white; costa black with three white patches; third vein broadly white in the middle. Palpi of female with white rings at the bases of the joints.

The larvae occur in ground pools and edges of streams. The adult is a dangerous malaria carrier. It greatly resembles *punctipennis*, but is not really closely allied thereto.

Distribution.—Tropical and subtropical America, southwestern United States to northern Argentina.

United States Records.

CALIFORNIA: Stanford University (I. McCracken).
Stockton (H. J. Quayle).
Laguna Beach, July 25, 1918 (W. E. Hilton).
San Diego, May 19, 1916 (H. G. Dyar).
NEW MEXICO: Las Vegas Hot Springs, 1902 (T. D. A. Cockerell).
TEXAS: Devils River, May 5, 1907 (F. C. Pratt).
Brownsville, May 31, 1904 (H. S. Barber).

Subgenus COELODIAZESIS Dyar and Knab.

ANOPHELES (COELODIAZESIS BARBERI Coquillett.

Anopheles barberi COQUILLETT, Can. Ent., vol. 35, p. 310, 1903.

A rather small blackish *Anopheles* with unspotted wings. Mesonotum brown with dark hairs. Abdomen black, the hairs dark. Legs black, knee spots pale, but not contrasted. Wings uniformly black scaled without trace of spotting. Palpi of the female entirely dark.

The larvae live in the water in tree holes, which occur in otherwise dry forests, so that this species often bites where ground-breeding mosquitoes are absent. This species has not been tested in the malaria-carrying relation; but its close European relative, *plumbeus* Haliday and Stephens, is said to be capable of transmission, but from its habitat seldom has the opportunity.

Distribution.—Southeastern United States.

United States Records.

MARYLAND: Plummer Island, August 17, 1905 (H. S. Barber).
VIRGINIA: Bluemont, July 29, 1904 (F. C. Pratt).
NORTH CAROLINA: Tryon (H. G. Dyar).
SOUTH CAROLINA: Columbia, August 1, 1906 (A. C. Moore).
MISSOURI: St. Louis, August, 1904 (A. Busck).
MISSISSIPPI: Agricultural College, October 15, 1905 (G. W. Herrick).
ARKANSAS: Scott, October 2, 1908 (J. K. Thibault).

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[This index has been prepared in the editorial office of the Federal Bureau of Entomology and includes all generic, subgeneric, specific, and subspecific names included in the text. Valid generic names are in **boldface** type; valid specific names in roman; synonyms in *italics;* species group names in SMALL CAPITALS.]

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FISHES FROM FORMOSA AND THE PHILIPPINE ISLANDS.

By Henry W. Fowler,
Of the Academy of Natural Sciences of Philadelphia,
and
Barton A. Bean,
Of the United States National Museum.

The collections here noticed embrace 588 specimens of fishes, the majority of which were obtained by Dr. Fred Baker at Takao, Formosa, and at Cebu and Zamboanga, Philippine Islands. The remaining few were collected by Dr. Hans Sauter at Koroton, Kagi, and Lake Candidius, in Formosa. A series of the duplicates is to be deposited in the Academy of Natural Sciences of Philadelphia.

The species here recorded represent largely the fauna of the East Indies, Japan, and China. A number are here introduced for the first time as new records both for Formosa and the Philippines, while several rare or little-known forms are described and a number of more or less interest are noted briefly, as some of their salient characters present new information to the study of variation.

We describe as new generic names *Rhamphodermogenys* and *Rhabdosebastes*. As new species *Cirrhinus melanostigma*, *Dermogenys bakeri*, and *Pomacentrus formosanus* are described and figured, besides which we give a figure of the rare seahorse, *Hippocampus longirostris* Cuvier, a species based on the ancient figure by Willughby.

Family DASYATIDAE.

DASTYATIS KUHLII (Müller and Henle).

Body entirely smooth. In alcohol above buffy-brown, dusky specks scattered rather closely about eyes, interorbital and frontal region. Scattered about more fleshy part of disk many variable puritan-gray round spots with dark borders. These spots mostly larger on each side behind. Lower surface of body whitish, edges slightly dusky, especially laterally. Tail darker brown than disk, with three broad olive-buff rings. Length, 613 mm.; snout to vent, 123 mm. Cebu.

Family CHIROCENTRIDAE.

CHIROCENTRUS DORAB (Forskål).

One from Cebu, 160 mm. long.

Family CLUPEIDAE.

DUSSUMIERIA ACUTA (Valenciennes).

One in very poor preservation, 158 mm. long. Head, 3⅘. Gill-rakers 14+35, about 1½ in eye. Cebu.

HARENGULA MOLUCCENSIS Bleeker.

Head, 3½ to 3⅜; depth, 4 to 4⅓; D. III, 14; A. III, 16, sometimes 15; scales (counted by pockets), 40 in lateral series from upper hind edge of gill-opening to caudal base; snout, 3¼ to 3½ in head measured from upper jaw tip; eye, 3¼ to 3⅜; maxillary, 2 to 2⅛; interorbital, 4 to 5⅔. Gill-rakers 14+33, fine, longest seven-eighths of filaments, which are seven-eighths of eye. Scales very deciduous, with 4 transverse vertical striae and sometimes as many more marginals. Abdominal serrae, 16 or 17+13 or 14. One small example with caudal tips broadly blackish, in others uniform. Most adults with inner angle or hind edge of caudal dusky. Sixteen examples, largest 120 mm. Takao.

Gunther gives about 38 gill-rakers on lower part of the arch.

Family ENGRAULIDIDAE.

ANCHOVIA BALIENSIS (Bleeker).

Head, 4⅓ to 4½; depth, 5 to 5½; D. III, 13; A. II or III, 16 or 17; snout, 3⅞ to 4½ in head; eye, 3¼ to 3¾; interorbital, 3½ to 4; maxillary, 1⅓ to 1⅔, reaches hind preopercle edge or only very slightly beyond. Closed mandible tip about opposite first third in snout length. Teeth in both jaws and maxillary toothed to hind edge. Opercles smooth. Abdominal spines, 4, occasionally 5. Gill-rakers, 20+22, slender, fine, slightly longer than filaments or 1¾ in eye. Scales caducous, in lateral series about 35 pockets to caudal base, and 20 or 21 predorsal. Ventral scaly flap nearly long as fin. Color in alcohol faded twany-olive. Head with brassy tinge. Median silvery-white lateral band, its greatest expansion over front of anal, where little less than eye, though little more than pupil. On occiput, or at front of predorsal, blotch of bister about size of eye. Iris colonial-buff. Fins all paler than body, dorsal and caudal with grayish tints. Four examples, 137 to 145 mm. Takao.

ANCHOVIA ZOLLINGERI (Bleeker).

Head, 3⅔ to 3¾; depth, 5⅓ to 6¾; D. III, 10; A. III, 18; snout, 4 to 4¼ in head; eye, 3⅓ to 3¾; maxillary, 1⅓, not reaching preopercle edge;

interorbital slightly less than eye. Opercle smooth. Gill-rakers about 17+17, very fine, slender, elongate, much longer than filaments or nearly equal eye. Color in alcohol dull saccardo-umber. Several blackish dots on opercle, shoulder-girdle and row along lower side of abdomen and caudal base. Iris silvery-white. Fins pale uniform brown. Top of head whitish behind eyes. Twenty-five examples, largest 40 mm. Takao.

Family SYNODONTIDAE.

SAURIDA GRANDISQUAMIS Gunther.

Head, 3⅘ to 4⅛; depth, 8½ to 9¼; D. III, 10, I; A. III, 9, I; tubular scales (according to pockets), 42 to 45 in lateral line to caudal base, and 3 to 4 more on latter; 3 (pockets) scales above lateral line to dorsal origin; 18 predorsal (pockets) scales; snout, 4 to 5 in head from upper jaw tip; eye, 3¾ to 5; maxillary, 1⅖ to 2⅖; interorbital, 5 to 6, slightly concave. Apparently no adipose eyelid. Gill-rakers about 24+48, lanceolate, slender and somewhat irregular, about 3 in filaments and latter 3 in eye. Scales each with 3 short marginal striae and circuli moderately fine. Dorsal base three-fifths of fin, which is about long as head. Depressed pectoral not reaching within at least 2 scales of dorsal origin. Color in alcohol faded dull brownish above to pale or whitish beneath. Dorsal tinged dusky terminally. Iris whitish. Eight examples, 55 to 90 mm. Takao.

Our examples all in poor preservation. Chiefly on account of their large scales we identify them with the present species, originally described from the Louisades and doubtfully Australia. Apparently not previously reported from Formosa.

TRACHINOCEPHALUS MYOPS (Schneider).

Eleven examples, 50 to 180 mm. Takao.

Family PLOTOSIDAE.

PLOTOSUS ANGUILLARIS (Bloch).

Head 4⅓; depth, 7½; nasal barbels reach slightly beyond front eye edge; maxillary barbel to hind eye edge; body without pale longitudinal lines; color variably warm sepia; paler to tawny-olive below; vertical fins with dusky edges; mental barbels little paler than upper, though dotted with brown. Length, 130 mm. Cebu

Also 33 examples, all young, from Zamboanga. Color in alcohol bister, often tinged dark grayish-brown on head. White lines from side of snout tip along each side of caudal base back to caudal. Another from each maxillary end along middle of side of head, extends below eye and fades out behind along middle of side of trunk. Largest, 45 mm.

Family SILURIDAE.

PARASILURUS ASOTUS (Linnaeus).

Two from Koroton, Formosa, September 1 to 15, 1907. Hans Sauter. Length, 145 to 175 mm.

Oshima[1] gives the maxillary barbels nearly as long as the head. In our smaller example only the left is slightly less than the head. In the larger example they both extend back close to tips of depressed pectorals. Lower jaw well protruded.

Family CYPRINIDAE.

CYPRINUS CARPIO Linnaeus.

One from Koroton, same data as preceding. Length, 183 mm.

CARASSIUS AURATUS (Linnaeus).

Five, same as preceding. Length, 97 to 128 mm.

CIRRHINUS MELANOSTIGMA, new species.

Head, 4⅓; depth, 3; D. iii, 12, i; A. iii; 5, i; P. i; 16, V. i, 8; scales. 37 in lateral line to caudal base and 4 more in latter; 9 scales above lateral line to dorsal origin, 7 below to anal origin, 5 below to ventral origin; 18 predorsal scales; head width, 1⅖ in its length; snout, 3; eye, 3⅗; mouth width, 3; maxillary, 4⅕; interorbital, 2⅕; first branched dorsal ray, 1+⅙; first branched anal ray, 1⅕; pectoral, 1⅕; ventral, 1⅕; least depth of caudal peduncle, 1⅘; lower caudal lobe. 1+⅔.

Body elongate, slender, well compressed, deepest at dorsal origin, edges convex, breast and belly broadly so. Caudal peduncle well compressed, little longer than deep.

Head conic in profile, little compressed and rather flattened sides but slightly constricted below eyes. Snout depressed, obtuse, length three-fifths its width and protrudes slightly beyond upper jaw. Eye large, high, hind pupil edge midway in head length. Mouth broad, inferior, gape short. Jaw edges coriaceous, firmly trenchant. Upper lip fringed, fleshy points rather coarse. Lower lip papillose. Pair of rostral barbels extending back far as maxillary end, which reaches opposite front nostril. Nostrils adjoining or simple front one at last two-fifths in snout and with fleshy flap exposing hind one in larger crescent. Interorbital broadly convex. Preorbital long as eye, other elements of suborbital chain narrow. Opercle smooth.

Gill-opening lateral, extends forward about opposite hind preopercle edge leaving broad isthmus. Gill-rakers very short, fringe of numerous slender fleshy points, about 10+65 and 7 in gill-filaments. Latter long as eye, and pseudobranchiæ about half as long. Branchiostegals 3—3, broad. Pharyngeal teeth, 2, 4, 5—5, 4, 2, short, all ends beveled at broad grinding surfaces so that molariform.

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[1] Ann. Carnegie Mus., vol. 12, 1919, p. 177.

Scales adherent, in even longitudinal rows, little smaller along body edges, and especially small along median line of belly and on breast. Caudal base covered with rather large scales. Ventral axil with long pointed scaly flap nearly three-fifths of fin. Apical radiating striae 30 to 32, and basal circuli fine. Lateral line midway along sides, complete, of short simple tubes, each little exposed.

Dorsal origin much nearer snout tip than caudal base, depressed fin 1⅗ to latter. Anal origin little nearer caudal base than ventral origin, depressed fin reaching caudal base. Pectoral reaches about three-fourths to ventral, latter inserted little behind dorsal origin or midway between pectoral and anal origins. Caudal greatly forked, lobes long and pointed. Vent close before anal origin.

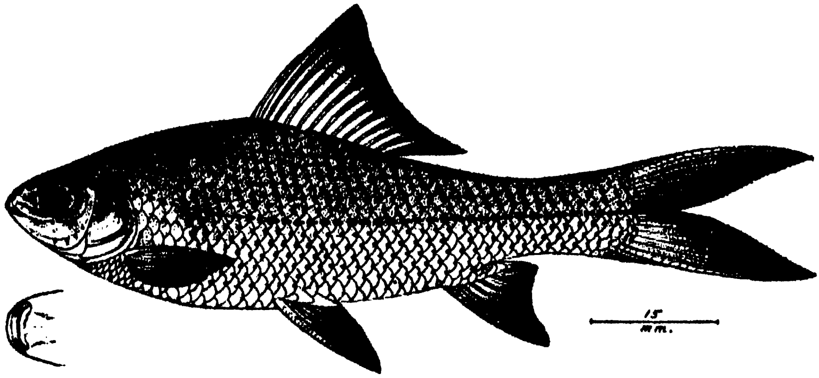

FIG. 1.—CIRRHINUS MELANOSTIGMA, NEW SPECIES.

Color in alcohol with back dull sepia-brown generally, becoming nearly clay-color on sides and especially below. Pocket at base of each scale with cluster of dusky dots, which shining through appear as if at apical part of scale, on back and sides. These spots begin about over middle of depressed pectoral, where for about first three scales in width all black and formed as a conspicuous marking, slightly inclined backward. Sides of head below with traces of whitish or silvery reflections. Iris with dull yellow tint. Fins very pale brownish, dorsal slightly more grayish and former transverse dusky-gray shade over membranes just below middle of fin.

Length 190 mm.

Type.—Cat. No 84168, U.S.N.M. Koroton, Formosa. September 1 to 15, 1907. Hans Sauter.

Also two others, paratypes, same data, showing: Head 4 to 4⅕; depth, 3 to 3¼; D. III, 12, I or 13, I: A. III, 5, I; scales, 36 or 37, in lateral line to caudal base and 4 more on latter; 8 or 9 scales above lateral line to dorsal origin, 7 below to anal origin; 14 or 15 predorsal scales; snout, 3 to 8⅓ in head; eye, 4; mouth width, 8⅓ to 3⅔; interorbital, 2⅕ to 2⅓; length, 180 to 185 mm.

This species greatly resembles *Cirrhinus mrigala* (B. Hamilton), of which we have slightly smaller examples from India for comparison. It differs, however, in its fringed lips, much shorter maxillary and especially in the prominent apical striae. These characters are not evident in our specimen of *C. mrigala.* From *C. reba* (B. Hamilton), of which we also have Indian examples for comparison, while its upper lip agrees in being fringed its lower lip is entire and not papillose. Also it has shorter barbels, a longer maxillary and nearly smooth scales, without the apical striae of *C. melanostigma.*

(Μέλας, black; στίγμα, spot.)

ZACCO TEMMINCKI (Schlegel).

Head, 3⅕ to 3⅓; depth, 3⅓ to 3½; D. II, 7; A, III, 9; scales, 46 to 48, in lateral line to caudal base and 4 more on latter; 10 scales above lateral line to dorsal origin, 4 or 5 below to anal origin; 19 to 24 predorsal scales; snout, 2⅞ to 3 in head; eye, 5⅛ to 5½; maxillary, 2⅕; interorbital, 2¼ 2⅞.

Body strongly compressed, deepest at dorsal origin. Caudal peduncle compressed; least depth, 2⅔ to 2¾ in head. Snout convex; length, ⅘ to 1 in its width. Eye small, hind edge about midway in head. Mouth large, jaws about even. Maxillary reaches opposite eye. Interorbital slightly convex. Gill-rakers, 2+6 short points; about 3 in filaments, which nearly equal eye. Pharyngeal teeth, 1, 4, 4—3, 4, 2, conic, some slightly hooked, with grinding surfaces, especially on larger ones. Scales rather narrowly imbricated along lower sides, closely crowded on chest. Each scale with about 7 to 11 rather weak apical radiating striae, fine circuli 52 to 63 basally. Spawning male with four rows of pearl organs along side of mandible, several rows along preopercle flange and lower part of opercle and irregular double row on suborbital chain. Enlarged anal rays of male with rows of pearl organs, well spaced basally and closer terminally. Lateral line greatly decurved, complete, of simple tubes.

Color in alcohol brownish generally, little paler below. Leaden-dusky streak along vertebral axis after dorsal fin. Ten obscure leaden cross bars between occiput and caudal. Iris gray-brown. Fins uniform brownish, except dorsal, which has transverse blackish band over membranes, but not on rays. Length 104 to 116 mm. Three examples from Kagi, Formosa. September 1 to 20, 1907. Hans Sauter.

ZACCO PLATYCEPHALUS (Gunther).

Head, 3¼ to 3⅜; depth, 3⅓ to 3½; D. III, 7, I; A. III, 9, I; scales, 47 to 50 in lateral line to caudal base and 3 more on latter; 8 scales above lateral line to dorsal origin, 5 below to anal origin; 22 to 24 predorsal scales; snout, 3⅛ to 3⅓ in head; eye, 3½ to 4½; maxillary, 2 to 2⅜; interorbital, 3.

Body compressed, deepest at dorsal origin, edges all convex. Least depth of caudal peduncle, 2⅛ to 2⅔ in head. Head well compressed, attenuate. Snout conic; length four-fifths its width. Eye elevated, hind edge midway in its length, little posterior in young. Mouth large, lower jaw included in upper, which slightly projects. Maxillary reaches eye center, to front pupil edge in younger. Lips firmly coriaceous. Interorbital very slightly convex. Suborbital chain broad, covers half of cheek to preopercle ridge. Opercle smooth. Gill-opening forward to hind eye edge, or slightly more advanced in younger. Gill-rakers, 3+8 short joints, about 5 in filaments, which are 1¼ in eye. Pharyngeal teeth, 1, 4, 5—5, 4, 1, hooked and with well-developed grinding surfaces. Scales little larger and narrowly imbricated on costal region. Very small scales on breast and belly anteriorly. Each scale with radiating apical striae 8 to 10, basal circuli fine. Axillary ventral scaly flap about 5 in fin. Lateral line deeply decurved, slopes up along caudal peduncle side to caudal base medianly, complete, and simple tubes well exposed. Dorsal origin little nearer caudal base than snout tip, and depressed fin reaches about half way to former. Anal with second and third branched rays reaching back to middle of caudal, shorter in younger example, and origin of fin opposite depressed dorsal tip. Caudal deeply forked, lobes pointed and lower often slightly longer. Pectoral 1⅓ to 1⅔ in head, not reaching ventral. Latter inserted trifle before dorsal origin, not reaching anal, 1⅘ to 2 in head.

Color in alcohol faded dull brown, little paler below. Dark narrow streak follows each row of scales on back. Leaden median line along vertebral axis from above ventral to caudal base medially. Fins all pale or dull brownish. Dorsal with median blackish blotch in each membrane. Caudal with grayish marginally behind. Nine examples from Koroton. September 1 to 15, 1907. Hans Sauter.

BARBUS SNYDERI (Oshima).

Head, 3 to 3⅔; depth, 2⅜ to 2⅘; D. II, I, 8, I, sometimes 7, I; A. III, 5, I, sometimes 6, I; scales, 22 or 23 in lateral line to caudal base and 2 to 4 more on latter; 5 scales above lateral line to dorsal origin, 2 or 3 below to anal origin; 8 or 9 predorsal scales; snout, 3⅔ to 3⅞ in head; eye, 2⅔ to 3; maxillary, 3 to 3⅛; interorbital, 2⅜ to 2⅗. Barbels, 4, posterior long as eye. Gill-rakers, 3 or 4+9 or 10, about 4 in filaments and latter 1½ in eye. Pharyngeal teeth, 2, 3, 5—5, 3, 2, hooked, with moderate grinding-surfaces and one or two of outer row little enlarged basally and less marked. Scales with 5 to 10 basal radiating striae, basally 4 or 5 lobes, and 3 to 8 apical radiating striae, circuli very fine. Color in alcohol dull natal brown on back with lavender reflections. Lower surface paler to whitish with silvery reflections. Margins of most scales on back and sides each with border of fine dusky dots, giving all appearance of darkened edges. Underlaid lateral leaden vertebral streak. Along this, row of four brackish spots, little larger than pupil and not large as eye. First of these humeral, next opposite dorsal origin, third opposite tip of depressed dorsal and last at caudal base. Another blackish spot opposite and close to dorsal origin. With age most of spots fade or become obsolete, only caudal and one at dorsal origin usually remaining. Head natal brown like back, side and iris silvery-white, and under surface paler. Dorsal and caudal grayish, other fins largely pale or whitish, only minute pale brown dots medianly or terminally. Fourteen from fresh waters of Zamboanga. Length 30 to 67 mm.

We find all of our examples with four barbels well developed. In Oshima's account of *Puntius snyderi*[1] the present species is placed in *Puntius*, as it is believed to be without barbels. In fact he emphatically separates *Puntius* from *Capoeta* and *Barbodes*, primarily by the absence of barbels. We do not feel justified in attempting to limit our material on this character alone, and as it in most all respects answers Oshima's *Puntius snyderi* are forced to consider it such. Gunther[2] pertinently says of *Barbus* "even the number of barbels is not quite constant, and much caution is required in determining whether a specimen belongs to a species normally with four or two, or without barbels, as these organs are sometimes quite rudimental, and abnormally, may be entirely absent; this is principally the case with the upper barbel, which I have found sometimes on one side and not on the other. Yet on such characters have naturalists ventured to found genera!"

Family COBITIDAE.

MISGURNUS DECEMCIRROSUS (Basilewsky).

Head, 5⅘ to 5⅓; depth, 5⅘ to 5⅓; D. II, 7; A. II, 7; scales, 94 to 116 in lateral line to caudal base; 14 or 15 scales above lateral line to dorsal origin, 11 or 12 below to anal origin; 60 to 70 predorsal scales; snout, 2⅗ in head; eye, 6½; mouth width, 4; interorbital, 3½.

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[1] Ann. Carnegie Mus., vol. 12, 1919, p. 216, pl. 50, fig. 2. Rigyokutsu; Maruyama; Daito River.

[2] Cat. Fish. Brit. Mus., vol. 7, 1868, p. 84.

Gill-rakers, 5+14, short, compressed strongly, truncate, 3 in filaments and latter equals eye. Scales with 21 to 26 basal radiating striae, of which about 12 to 18 incomplete and marginal, and circuli fine. Color in alcohol dull to dark dusky on back and dull brown below. Sides and back with numerous fine or small ill-defined dusky spots, sometimes sparse and in other examples crowded. Fins pale brown, with dull spots or specks of darker, less distinct than on body. Three from Koroton. Hans Sauter. Length 88 to 125 mm.

Family ANGUILLIDAE.

ANGUILLA MAURITIANA Bennett.

Dorsal slightly nearer gill-opening than vent. In alcohol, brown, finally dotted and speckled with darker. Lower surface of head and abdomen paler. Length, 48 mm. Zamboanga.

Family CONGRIDAE.

CONGER ANAGO Schlegel.

Four examples, 197 to 257 mm., from Takao. Also one 198 mm., from Cebu. In the better preserved Formosan examples the lower surface of the head is conspicuous for three dark brown transverse bands. Of these, first at mandible tip, second about opposite middle of eyes, and third close behind hind eye edge.

Family MURAENIDAE.

STROPHIDON BRUMMERI (Bleeker).

Head, 11⅛; depth at vent, 36¾; to vent, 16; head width, 4 in its length; head depth, 2⅓; snout, 6⅔; eye, 12¼; mouth gape, 2⅔; interorbital, 9¾; head, 4¾ to vent.

Body very long, slender, well compressed, and long tail slender. Head compressed, slightly swollen at occipital region, sides flattened and but slightly constricted below. Snout compressed, upper surface convex, likewise profile, about long as broad. Eye little ellipsoid, hind edge about midway in mouth length, without eyelid. Mouth large, horizontal, completely closes. Lips moderate, tough, smooth. Teeth conic, entire, sharply pointed. Upper outer teeth with one just before eye little larger than others, all of which slightly inclined backward and becoming gradually smaller. An inner upper series of eight depressible teeth, slightly larger than outer series. Median row of seven depressible enlarged canines on vomer, last one little behind eye. Mandible with single outer row of teeth and anteriorly each side three larger teeth form an inner row, last of which well before eye. No tongue. Mandible elongate, shallow, surface convex, and equal in front with snout tip. Front nostril in short tube near snout tip. Hind nostril in interorbital space, above front half of eye, opens above at slit slightly inclined posteriorly. Interorbital slightly convex.

Gill-opening near lower fourth in body depth, slightly inclined, about long as eye. Pharynx well swollen, with number of obsolete grooves below. Skin smooth, tough. Six pores on each upper lip, first close to snout tip, second just behind nasal tube, third midway in snout, fourth below front eye edge, fifth behind hind eye edge, sixth midway in mouth behind eye. Nearly opposite along lower lip similar row of six pores on each side. Pair of pores between nasal tubes and two more pores posteriorly, last just before hind nostril. Lateral line of simple inconspicuous pores along side of body medially.

Dorsal origin at last third in space between rictus and gill-opening, fin of moderate height and continuous with small caudal. Latter slightly pointed, equals interorbital. Anal like dorsal, slightly lower. Vent close before anal.

Color in alcohol uniform olive to natal brown above. Snout, upper lip and mandible pale grayish-olive. Dorsal, anal and caudal margined with dusky to blackish. Gill opening pale. Iris pale slaty. Length, 1,032 mm. Cebu.

GYMNOTHORAX MELEAGRIS (Shaw).

One from Zamboanga, 177 mm. long (caudal end damaged). Its color pattern is somewhat like the nominal *G. ercodes* Jenkins, except that dark reticulations are more or less waved or variable, also showing more tendency to form narrow vertical lines. Median upper teeth opposite eyes, in two rows, rather short or bluntly conic.

ECHIDNA NEBULOSA (Ahl).

One from Zamboanga. Length 205 mm.

Family PEGASIDAE.

PARAPEGASUS NATANS (Linnaeus).

Snout tip to vent contained in tail, measured from vent to base of caudal fin, ⅞ to 1. D. 5; A. 5. Tail with 12 rings. Snout about 2⅛ to 2⅕ to vent; lateral edges denticulate, posterior denticles longer and directed backward; about 6 to 8 ridges, mostly complete, longitudinally and above. Color in alcohol general tint above clay color or tawny-olive, with five dusky obscurely defined transverse bands, first at nape, second above vent and others on tail. Upper surface, dorsal, pectoral and caudal all finely dotted with dusky. Lower surface immaculate, pale brown to whitish. Twenty-one examples from Takao; largest, 44 mm.

We have compared an example 95 mm. long in the Academy from Padang, Sumatra, which agrees in every way.

Family SOLENOSTOMIDAE.

SOLENOSTOMUS PARADOXUS (Pallas).

One example, 125 mm. long, from Takao. D. V—20; A. 20; rings, 14+16; depth of snout midway, 5⅞ in its length; caudal peduncle less than base of first dorsal.

Our example very closely resembles *Solenostomus paradoxus* Weber,[4] which may really only represent a younger stage of *S. paradoxus*. Its caudal peduncle is shorter than that shown in Weber's figure. The spinous dorsal has the first two membranes with a black blotch like that shown in Jordan and Snyder's figures of *S. cyanpterus* and *S. paradoxus*. Moreover, our example has the spinous dorsal terminally and caudal both terminally and marginally dusky. It is a female and still retains a number of eggs between the ventrals.

Family SYNGNATHIDAE.

GASTROTOKEUS BIACULEATUS (Bloch).

One from Cebu. Length, 228 mm.

HIPPOCAMPUS KUDA Bleeker.

Rings, 10+37 or 38. D. 18. Tubercles prominent, rather spinescent and a few filaments present. Supraorbital spine variable, simple, usually with broad base. Preorbital spine obsolete or absent. Coronet moderate. Snout 2⅛ to 2⅙ to gill opening. Low or obsolete median spine at base of snout before eye, usually scarcely distinguishable. Color in alcohol dull tawny-olive above to paler or whitish below. Back and sides all penciled, streaked, and speckled with dusky, mostly longitudinally. Brood-pouch of males similarly marked to opaque. Eye with six or more conspicuous white lines which radiate on adjacent ocular area. Four examples, three of which males with brood-pouches. Takao. Largest about 125 mm. long.

HIPPOCAMPUS LONGIROSTRIS Cuvier.

Rings, 10+35. D. 18. Tubercles rather conspicuous, without filaments. Supraorbital spine simple, slightly curved backward or obliquely truncated terminally, length half of eye. Preorbital spine well developed, though shorter than supraorbital. Coronet low. Snout nearly long as space from front eye edge to gill-opening. Well developed spine medianly just before preorbital at snout base.

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[4] *Siboga* Exped., Fishes, vol. 65, 1913, p. 103, fig. 33c. Arafura Sea.

Color in alcohol nearly dark bone-brown, with largely uniform appearance. Under a lens minute crowded paler dots, very numerous. Lower surface of head, tail and trunk cinnamon-buff. Many narrow bone-brown bands radiate from eye. Cebu. Length about 140 mm.

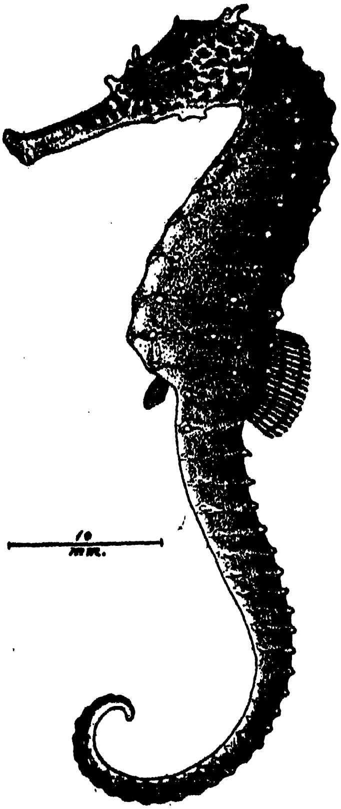

FIG. 2.—HIPPOCAMPUS LONGIROSTRIS CUVIER.

Family FISTULARIIDAE.

FISTULARIA PETIMBA Lacépède.

Two from Takao. Compared with Hawaiian and Philippine examples in the Academy, they agree in most every particular. The body is broadly depressed in comparison with *F. serrata*, the snout much shorter and less serrate and the posterior sides of the body are smooth. In the younger example the body has a velvet-like appearance. Length to tips of outermost caudal rays, 128 to 308 mm.

FISTULARIA SERRATA Cuvier.

Head, 2½; D. 16; A. 16; snout, 1¼ in head; eye, 1¼ in postorbital; interorbital, 1⅞. Body moderately depressed. Denticles along lateral rostral edges moderate, though extend about hind two-thirds of snout. Lateral line armed with a row of denticles, quite conspicuous along side of tail. Keels on upper surface of snout as in preceding species, except their distension less anterior. According to Gunther's figure,[5] their distension would occur medially. One from Takao, 335 mm. long.

Family CENTRISCIDAE.

CENTRISCUS STRIGATUS (Bleeker).

Head, 2⅜ to origin of soft dorsal fin; depth, 5½; D. IV, 10; A. 12; snout, 1⅓ in head; eye, 1⅜ in postorbital; interorbital, 2. Body extremely compressed, thin, and narrowly convex above, constricted below as broad thin trenchant edge. Head and body cuirassed with finely striate bony plates. Snout formed as compressed bony beak, but moderately recurved. Space between front eye edge and hind edge of gill-opening slightly less than space between gill-opening and pectoral origin. Pectoral extended downward seven-eighths to ventral origin. Color in alcohol with brown streak along upper half of snout posteriorly about wide as pupil and indistinct behind eye. Body largely transparent brownish. Iris silvery-white. Length, 107 mm. (dorsal spine damaged). Takao.

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[5] Rep. Voy. *Challenger*, vol. 1, 1880, pl. 32, fig. C.

We have compared this with an example in the Academy, without locality, 120 mm. long (tips damaged), which agrees in having four dorsal spines. The pectoral origin is, however, a little more posterior.

Family EXOCOETIDAE.

CYPSELURUS NIGRIPENNIS (Valenciennes).

Head, 3¾; depth, 5½; D. I, 9 or 10; A. I, 9 or 10; snout, 3⅓ to 3⅘ in head from upper jaw tip; eye, 2⅓ to 2⅔; maxillary, 3⅓ to 3⅕; interorbital; 2½ to 2⅔. Snout tip to hind preopercle edge equals length of head depth. Snout, two-thirds of eye. Interorbital slightly concave. Gill-rakers, 7+14, lanceolate, nearly long as filaments, which 2½ in eye. Scales with 4 or 5 short basal striae, edge scalloped, circuli moderately fine. Pectoral reaches middle of dorsal base. Ventral inserted midway between front eye edge and caudal base, reaches second branched anal ray base. Dorsal origin little before that of anal, fin rounded and median rays nearly long as head. Color in alcohol largely silvery-white. Back neutral-gray, with portions of dorsal, pectoral and ventral black, though last one or two caudal rays whitish and pectoral base pale. Caudal and anal pale or whitish. Three examples, 57 to 70 mm. long. Takao.

CYPSELURUS BRACHYSOMA (Bleeker).

Head, 4; depth, 5; D. I, 10; A. I, 8; snout, 4 in head from upper jaw tip; eye, 3; maxillary, 4; interorbital, 2⅔. Body well compressed. Head width, 1¾ its length. Snout depressed, length ⅔ its width, ¾ of eye. Maxillary about opposite middle in nostril. Interorbital very slightly concave. Head depth equals space between snout tip and hind preopercle edge. Gill-rakers, 5+16, lanceolate, about three-fourths of filaments which 1¾ in eye. Scales mostly fallen, about 24 between hind eye edge and dorsal origin. Scales with 2 or 3 basal radiating striae, circuli fine. Pectoral reaches about eighth branched dorsal ray base. Ventral inserted midway between hind pupil edge and caudal base, reaches about opposite middle in depressed anal length. Last dorsal ray long as eye. Color in alcohol apparently faded brownish. Pectoral blackish, edges pale or whitish. Dorsal and caudal brown. Ventral and anal whitish. Length, 153 mm. (caudal tips damaged). Cebu.

Our example agrees largely with Bleeker's figure,[6] except its ventral is inserted slightly more backward.

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[6] Atlas Ichth., vol. 6, 1866–72, pl. 1, fig. 1.

Family HEMIRAMPHIDAE.

HEMIRAMPHUS FAR (Forskål).

Head from upper jaw tip, 4⅜; depth, 6⅛; D. II, 11, occasionally II, 12; A. II, 9, rarely II, 10; scales, 50 in lateral line to caudal base; 38 to 40 predorsal scales; snout, 2¾ to 2⅞ in head from upper jaw tip; eye, 3¾ to 4; maxillary, 3¼ to 3⅜; interorbital, 3⅓ to 3⅞. Five examples, 288 to 500 mm. Takao.

DERMOGENYS PUSILLUS Kuhl and Van Hasselt.

Head from upper jaw tip, 4; depth, 6⅖; D. II, 8; A. II, 13; P. I, 9; V. I, 5; scales, 40? from gill-opening above to caudal base and 4 more or latter; 32? predorsal scales; snout, 3⅗ in head; eye, 3⅖; maxillary, 2⅗; interorbital, 2¾; first branched dorsal ray, 2⅛; longest anal ray, 1½; least depth of caudal peduncle, 2⅖; caudal, 1⅗; pectoral 1⅛; ventral, 2⅕.

Body moderately long, well compressed, deepest about midway in length. Caudal peduncle long as deep.

Head well compressed, flattened, sides narrowly convergent below, width 2¼ in its length from upper jaw tip. Upper jaw depressed, short or broadly triangular, length about four-fifths its width at front of eyes. Eye large, slightly less than snout, impinges on upper profile and hind edge slightly behind middle in head length as measured from snout tip. Mouth with short horizontal gape, about two-thirds of eye. Maxillary largely concealed by preorbital, reaches eye. Narrow series of small uniform conic teeth in lower jaw basally, none in upper. Nostrils minute. Interorbital slightly concave.

Gill-opening extends forward opposite front pupil edge. Gill-rakers, 2+16?, short weak points, about one-fourth of gill-filaments, which half length of eye. Isthmus narrow slender frenum.

Scales rather large, cycloid, moderately imbricated, basal striae 5 and circuli about 17, complete. Head scaly, single row of large scales on cheek, and opercles scaled. Caudal base with 5 rows of scales. Lateral line incomplete, at least tubes obsolete or irregular behind ventrals.

Dorsal origin at last fourth in space between hind edge of gill-opening and caudal base, and last ray reaches latter. Anal inserted a little in advance of dorsal origin, larger than dorsal, though last ray falling well short of caudal base. Caudal rounded (edges damaged). Pectoral high, reaches three-fifths to ventral. Ventral placed midway between preopercle ridge and caudal base, reaches slightly less than half way to anal. Vent about last fourth in space between ventral and anal origins.

Color in alcohol, faded dull brownish, nearly uniform. Upper surface of head and down middle of back dusted with dusky specks or minute dots. Predorsal with two parallel dusky lines, close set, formed of dusky dots. Median lateral line of dusky from shoulder to caudal base medianly. No silvery lateral band. Iris slaty gray. Fins all pale brownish.

Length, 45 mm. (ends damaged).

One from Zamboanga.

Among the examples of Philippine fishes studied in the Commercial Museum of Philadelphia were several specimens of this species which we have not since located. Of this lot, nine examples presented to the Academy were listed as *Dermatogenys viviparus* (Peters).[7] This is wrong, and we find them to be *Hyporhamphus neglectus*. They agree with an example from Sumatra, though all are a little smaller, besides in very poor preservation. Likely all may eventually be united with *Hyporhamphus unifasciatus* (Ranzani) as contended by Gunther and Bleeker.

Hemiramphus viviparus Peters,[8] judging from its description, appears inseparable from *Dermogenys pusillus* Kuhl and Van Hasselt.

RHAMPHODERMOGENYS, new subgenus.

Type.—Dermogenys bakeri, new species.

Distinguished from subgenus *Dermogenys* Van Hasselt by its long upper jaw and advanced ventrals.

One species.

Both *Hemiramphus brachijnotopterus* Bleeker[9] and *Hemiramphus sumatranus* Bleeker[10] appear to belong to the subgenus *Dermogenys*.

(Ραμφος, snout; Dermogenys.)

DERMOGENYS BAKERI, new species.

Head from upper jaw tip, 3¼; depth, 6½; D. II, 8; A. II, 13; P. I, 10; V. I, 5; scales from gill-opening at shoulder 39 to caudal base; 4 scales above lateral line to dorsal origin, and 5 below to anal origin; 33? predorsal scales to head; snout, 2¼ in head as measured from its own tip; eye, 4⅕; maxillary, 2⅛; interorbital, 3⅜; first branched dorsal ray, 2⅞; second simple anal ray, 1⅞; least depth of caudal peduncle, 3½; caudal (tip damaged), 1¾; pectoral, 1½; ventral, 2⅝.

Body moderate, strongly compressed, or back broad and flattened sides well converging below. Caudal peduncle about as long as deep.

Head well compressed, sides flattened and narrowly converging below; width, 2⅝ in its length from upper jaw tip. Upper jaw depressed, lanceolate, width 1⅝ in its length. Eye large, slightly impinging in upper profile, and eye center very little behind middle in head length as measured from snout tip. Mouth with long gape, reaches five-sixths to eye. Maxillary small, concealed by preorbital, reaches eye. Row of moderately small and nearly uniform conic simple teeth in each jaw. Front upper teeth form somewhat horseshoe-shaped pattern, contiguous each side with lateral row. Lower teeth in rows not approximated forward, graduated slightly, and obsolete little before tip of depressed upper jaw. Nostrils minute. Interorbital concave.

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[7] Proc. Acad. Nat. Sci., Phila., 1919, p. 10.

[8] Monatsb. Akad. Wiss. Berlin, 1865, p. 132. Samar and Luzon.

[9] Verh. Batav. Genoot. (Bengal) vol. 25, 1853, p. 146. River Hooghly, Calcutta.

[10] Nat. Tijds. Ned. India, vol. 5, 1853, p. 526. Lake Meninju, Western Sumatra.

Gill-opening extends forward little before front pupil edge, though not to front eye edge. Gill-rakers, 2?+17 short weak points, about one-fourth of gill-filaments, which about 3 in eye. Isthmus narrow slender frenum.

Scales large, cycloid, moderately imbricated, basal striae 5 to 12 anal circuli complete, 18 to 20. Head scaly. Single row of large scales on cheek. Caudal base with five rows of scales. Anal base scaly, also opercles. Lateral line incomplete, apparently (many scales fallen) not extending much beyond ventral base.

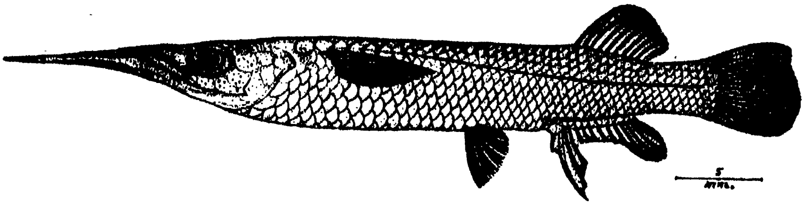

FIG. 3.—DERMOGENYS BAKERI, NEW SPECIES.

Dorsal origin little behind last third in space between hind edge of gill-opening and caudal base, and depressed fin not quite reaching latter. Anal inserted little before dorsal origin, fin larger than dorsal, though when depressed falls well short of caudal base. Caudal rounded (edges damaged). Pectoral high, fin reaches three-fourths to ventral origin, nearly midway between hind eye edge and caudal base, reaches two-thirds to anal. Vent about last fourth in space between ventral and anal origins.

Color in alcohol, faded dull isabella-brown, nearly uniform. Upper surface of head and down middle of back dusted with dusky specks or minute dots. Predorsal with two close-set parallel lines, formed of dusky dots. Median lateral line of dusky from shoulder to caudal base, ending at latter medially, though no silvery lateral band. Iris gray-white. Fins pale brown.

Length, 43 mm. (caudal ends damaged).

Type.—Cat. No. 84275, U.S.N.M. Zamboanga, Philippine Islands. Dr. Fred Baker.

Only the above example known.

(Named for its discoverer, Dr. Fred Baker.)

Family SPHYRAENIDAE.

SPHYRAENA AUREOFLAMMEA Seale.

Head, 2⅛; depth, 6⅜; D. V—I, 9, i; A. II, 9, i; tubular scales, 81 in lateral line (mostly fallen) to caudal base, and about 8 more on latter; 10 scales above lateral line to spinous dorsal origin, 10 below to spinous anal origin; 26 (pockets) predorsal scales to occiput; snout, 2¼ in head from upper jaw tip; eye, 5⅛; maxillary, 2⅗; interorbital, 6½. Gill-rakers, 2, lanceolate, on cerato-branchial, about two-thirds of filaments or 3 in eye. Scales with 28 to 34 basal parallel striae, circuli fine. Maxillary reaches nostril, but not quite to eye. Spinous dorsal begins opposite tip of pectoral. Ventral origin nearer pectoral base than spinous dorsal origin. Color in alcohol, brownish above, paler below. Length, 163 mm. (caudal damaged). Cebu.

Our example agrees in most every way with Seale's account. In the short maxillary not extending to the eye it is certainly near *Sphyraena langrar* Bleeker and *S. brachygnathus* Bleeker. Of these the former is said to have the snout nearly twice as long as the eye and larger scales. In the latter the body is much more slender and the eye larger.

Family MUGILIDAE.

MUGIL TROSCHELII Bleeker.

Head, 3¾; depth, 4; D. IV—I, 8; A. III, 9, i; scales, 33 from gill-opening to caudal base; 12 scales transversely between soft dorsal and anal origins; 20 predorsal scales; snout, 3½ in head; eye, 3¾; mouth width, 3; interorbital, 2⅗. Gill-rakers about 31+50, finely lanceolate, 1½ in filaments or 1¾ in eye. Scales with 5 radiating basal striae, and circuli very fine. Five scales between depressed spinous dorsal tip and soft dorsal origin. Preorbital scaly, with fine denticles. Pectoral axillary scale slightly less than half of fin. Soft dorsal largely scaled, anal likewise and its front fourth before soft dorsal origin. Maxillary reaches level of lower preorbital edge, slightly uncovered. Spinous dorsal slightly higher than soft fin, its origin midway between front pupil edge and caudal base. Least depth of caudal peduncle, 2⅗ in head; pectoral length, 1⅗. Caudal emarginate. Color in alcohol, dull brownish, mostly uniform. Caudal with slight wash of pale dusky. Length 148 mm. Cebu.

Evermann and Seale have noted and figured this species as *Liza troschelii*[11] from Manila. They say the origin of the anal is under the origin of the soft dorsal, though their figure shows it well in advance and as found in our example. Also, they say the pectoral is long as the head, though they figure it much shorter. The axillary pectoral spot they mention is hardly evident in our example.

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[11] Proc. U. S. Nat. Mus., vol. 31, 1907, p. 506, fig. 1.

Family HOLOCENTRIDAE.

HOLOCENTRUS RUBER (Forskål).

Head to hind edge of opercular membrane, 2⅞ to 3⅛; depth, 2⅔ to 2⅘; D. XI, 13; A. III, 9, I; tubular scales, 33 to 35 in lateral line to caudal base; 3 scales above lateral line to soft dorsal origin, 7 or 8 below to spinous anal origin; 6 predorsal scales; snout, 4 in head; eye, 2⅘ to 3¼; maxillary, 2⅔ to 2¾; interorbital, 3⅗ to 3½. Gill-rakers, VI, 1+6, IX, lanceolate, seven-eighths of filaments, 2 in eye. Preopercle spine long as eye, serrae along hind edge of preopercle variable. Color in alcohol, pale brown generally, with silvery reflections. Obscure brown blotch at bases of soft dorsal and anal, posteriorly on latter, also on caudal, though extending slightly along upper and lower edges of fin lobes. Ventral tip and first anal ray brownish. Two examples, 235 to 265 mm. (caudal damaged). Zamboanga.

Our examples appear to agree with *Holocentrum melanospilum* Bleeker,[12] which has been placed as a synonym of the present species.

Family SCOMBRIDAE.

SCOMBER KANAGURTA Rüppell.

Head, 3¾; depth, 4 to 4⅕; D. X—II, 11 I, 5; A. II, 10, 5: snout, 3⅓ to 3⅗ in head; eye, 4; maxillary, 2½; interorbital, 3⅗ to 3⅘. Gill-rakers about 13+21, firmly and slenderly clavate, very slightly less than filaments, which equal eye. Scales with circuli vertical, fine, all more or less parallel, only slightly diverging at scale center, and circuli about 80 to 88 in horizontal or transverse count. Color in alcohol, back dark greenish or blue-gray to slaty, sides and lower surface whitish with silvery tints. Back marked with several rows of slightly darker spots. Fins pale brown, hind edge of spinous dorsal dusky. Iris whitish. Length, 230 to 238 mm. Two from Takao.

These agree with Sumatran examples in the Academy. We accept Bean and Weed's conclusions[13] from their study of Javan material. We take exception, however, to Russell as the authority for the species, as he is nonbinomial, and must be replaced by Rüppell. *Rastrelliger*, with the single species *R. brachysomus*, has increased gill-rakers, 23+44.

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[12] Atlas Ichth., vol. 9, 1877, pl. (5), 359, fig. 1.

[13] Proc. U. S. Nat. Mus., vol. 42, 1912, p. 602.

Family CARANGIDAE.

SCOMBEROIDES TOL (Cuvier).

Head, 3⅗ to 4½; depth, 3⅓ to 3⅔; D. I, VII—II, 20, once 19; A'. II—I, 19, occasionally 18; snout, 3 in head from upper jaw tip; eye, 3¼; maxillary, 2; interorbital, 3½. Gill-rakers, 6 or 7+18 or 19. Color in alcohol, back bluish-gray, sides and below silvery-white. Row of seven obscure small spots along side of back. Membranes of spinous dorsal blackish, also apex of soft dorsal, though rest of fin gray. Caudal pale, grayish behind. Other fins pale. Iris silvery-white. Length, 45 to 163 mm. Eight from Takao.

All agree with examples in the Academy from Sumatra and the Philippines, the latter recorded as *S. tala* by Fowler.[14] Some of the same also have the pronounced external conic canines, but all have linear scales. On the contrary, Bean and Weed, they doubtless having examined the type, place *Eleira philippina* as a synonym of *Scomberoides lysan*.[15] Jordan and Seale do not describe or indicate in any way the nature of the scales. Such characters as they give would point to its association with *S. tala* (Cuvier), with which it is included by Jordan and Richardson.[16] However, a small Philippine example, 83 mm. long, in the Academy, which we believe to be the young of *S. lysan* (Forskål), has the maxillary reaching a little beyond the hind eye edge. Now, the type of *Eleira philippina*, 121 mm. long, is said to have the maxillary reaching only to the last third of the eye, which is apparently correctly indicated by the figure.

CARANX MATE Cuvier.

Head, 3¾; depth, 3⅒; D. VIII—I, 24; A. II—I, 20; scales, 40 in curve of lateral line, 53 in straight section, of which last 10 on caudal base; snout, 3⅕ in head; eye, 3½; maxillary, 2¾; interorbital, 3⅗. Gill-rakers, 11+28, lanceolate, slightly less than filaments, or 1⅘ in eye. Scales with circuli vertically parellel, 44 basal and 33 apical, confluent down vertical axis. Pectoral about equals arch of lateral line, which 1⅓ in straight section. Large dark blotch on hind opercle edge, little smaller than eye. Length, 120 mm. Cebu.

Though smaller, this agrees in most respects with Sumatran examples in the Academy. We note that *Caranx mate* Cuvier[17] has priority over *L. affinis* Rüppell,[18] which latter is mostly in use.

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[14] Proc. Acad. Nat. Sci., Phila., 1918, p. 14.

[15] Proc. U. S. Nat. Mus., vol. 42, 1912, p. 602.

[16] Philippine Journ. Sci., vol. 2, 1910, p. 19.

[17] Hist. Nat. Poiss., vol. 9, 1833, p. 40. Pondichery, Seychelles, New Guinea, Anjer.

[18] Neue Wirbelth., 1835 (March, 1838), p. 49, pl. 14, fig. 1. Red Sea.

CARANX MALABARICUS (Schneider).

Head, 2⅓ to 3; depth, 2 to 2⅒; D. VIII—I, 21 to 23, I; A. II—I, 17, I; snout, 2⅔ to 2⅓ in head from upper jaw tip; eye, 3⅔ to 4; maxillary, 2⅓ to 2¼; interorbital, 3⅓ to 3⅔; scales, 66 to 70 in curve of lateral line, 30 to 40 in straight section. Gill-rakers, 7 to 10+20 to 27, about 1⅔ in eye, or little longer than filaments. Scales with circuli vertically parallel, about 48 basal and 38 apical, confluent down median vertical axis. Pectoral slightly less than arch of lateral line. Straight section of lateral line 1⅓ to 1¾ in arch, latter greater with age. All show a dark blotch on hind preopercle edge, which equals pupil in largest example. Length, 150 to 175 mm. Three from Takao.

We have compared two younger examples in the Academy from Sumatra, which agree in every way, with allowance for age.

CARANX MANDIBULARIS Macleay.

Head, 4¼; depth 1⅞; D. VIII—I, 22; A. II—I, 17; scales, 54 in curve of lateral line, 40 in straight section; snout, 3⅔ in head from upper jaw tip; eye, 3⅓; maxillary, 2⅓; interorbital, 3⅖. Gill-rakers, 25+48, slender, lanceolate, little longer than filaments, or 1¼ in eye. Scales with 22 to 25 vertical parallel circuli apically or basally, confluent down median axis. Pectoral very long, curved, 1¾ to caudal base. No opercular spot. Blackish blotch in pectoral axilla. Length, 212 mm. Takao.

Our specimen undoubtedly represents an early stage of *Ulua richardsoni* Jordan and Snyder,[19] the type of which is said to be 451 mm. long. From their figure it differs at once in the prolonged dorsal and anal lobes, the former depressed backward far as tips of median caudal rays, and latter depressed backward opposite base of last anal ray. The contour of our example is deeply ovoid. Its maxillary extends back opposite front pupil edge, and the least preorbital width is only half the eye. It is undoubtedly allied with the species of *Citula* in its broadly naked breast, but may stand as a distinct subgenus, *Ulua*, on account of the great increased gill-rakers.

We may also note that *Caranx formosanus* Jordan and Snyder[20] is evidently a synonym of *Caranx malabaricus* (Schneider). Likewise *Caranx rastrosus* Jordan and Snyder[21] is probably a synonym of *Caranx plumbeus* (Quoy and Gaimard). Though the authors of *C. rastrosus* show their figure with a dark or blackish opercle, no mention of this is found in their description.

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[19] Mem. Carnegie Mus., vol. 4 (2), 1908, p. 39, pl. 53.
[20] Idem, p. 38, pl. 52. Takao.
[21] Idem, p. 37, pl. 1. Takao and Cavite.

Caranx mandibularis Macleay[22] appears to be the earliest name for the present species. It was based on examples about a foot in length. Though some minor differences may appear in comparing the original description, we doubt not that they are a condition of age or individual variation. For instance, the scutes are given as 60+45 and the long dorsal ray about equals the body depth.

CARANX ATROPOS (Forskål).

Head, 2⅗; depth, 1⅖; D. VIII—II, 20; A. II—II, 16; snout, 3⅓ in head; eye, 2⅔; maxillary, 2; interorbital, 2¾. Gill-rakers, 7+18, lanceolate, little longer than filaments, or 1⅞ in eye. Breast naked. First dorsal ray elongate, slender, depressed backward opposite caudal base. First anal ray elongate, extends backward little beyond caudal base. Pectoral obtuse, 1⅛ in head. Ventral blackish, reaches soft dorsal origin. No opercular spot. One, 43 mm. Takao.

Our example is identical with the Sumatran figured by Fowler as *Citula atropos* and which had the first branched dorsal and anal rays with broken tips. Just how much they may have been prolonged we can not determine. The same specimen was later wrongly associated with *Caranx armatus* (Forskål).[23] Our comparison with the Sumatran specimen shows it to belong as originally identified. The species is distinguished by its blackish ventrals.

SCYRIS INDICA Rüppell.

One, 168 mm. Takao. Agrees with Sumatran material in the Academy upon comparison.

Family SCORPIDAE.

MONODACTYLUS ARGENTEUS (Linnaeus).

Head, 3$\frac{1}{10}$; depth, 1⅓; D. VIII, 29, I; A. III, 29, I; scales, 58 in lateral line to caudal base and 5 more in latter; about 15 scales above lateral line to soft dorsal base; 40 scales below lateral line to spinous anal origin; snout, 4⅕ in head; eye, 2¾; maxillary, 3$\frac{1}{10}$; interorbital, 2$\frac{9}{10}$. Gill-rakers, 9+17, lanceolate, 1½ in filaments or 3 in eye. Scales each with single basal stria, circuli very fine, and minute apical denticles very numerous. Color in alcohol pale brownish generally, front lobes of soft dorsal and anal dusky, that of latter nearly blackish. Other fins pale, hind caudal edge grayish. Iris dark. Length, 147 mm. Cebu.

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[22] Proc. Linn. N. S. Wales, vol. 7, 1882, p. 356. New Guinea.

[23] Proc. Acad. Nat. Sci. Phila., 1905, p. 83.

Family LEIOGNATHIDAE.

LEIOGNATHUS VIRGATUS Fowler.

Head, 3¼ to 3⅓; depth, 1⅘ to 2; D. VIII, 16; A. III, 14; snout, 3 to 3⅒ in head; eye, 2⅓ to 2⅞; maxillary, 2⅒ to 3⅒; interorbital, 2¾ to 2⅞. Gill-rakers 5 or 6 + 17 to 20. Length, 80 to 108 mm. Two from Takao.

Our examples agree in most every respect with the types in the Academy, with which we compared them.

LEIOGNATHUS EQUULA (Forskål).

Head, 3⅓; depth, 2 to 2⅒; D. VIII, 16; A. III, 14; P. II, 16; V. I, 5; tubular scales (damaged), about 53 in lateral line to caudal base; about 12 scales (mostly pockets) in vertical series above lateral line to spinous dorsal origin, 22? below to spinous anal origin; head width, 1⅞ in its length; head depth at occiput equals its length; second dorsal spine, 1⅓; first dorsal ray, 3⅓; first anal spine, 1⅘; first anal ray, 2⅔; upper caudal lobe, 1⅒; pectoral, 1⅓; ventral, 2; snout, 3 to 3⅓ in head; eye, 2⅘ to 2⅞; maxillary, 2¾ to 2$\frac{9}{10}$; interorbital, 2⅘ to 3; least depth caudal peduncle, 4⅔.

Body somewhat elongate, contour ovoid, compressed, deepest about spinous dorsal origin, profiles alike. Caudal peduncle compressed, long as deep.

Head deep, compressed, profiles similar, flattened sides converging moderately below. Snout obtuse, somewhat pyramidal, very slightly protruding beyond lower jaw; length four-fifths its width. Eye large, close to upper profile, hind pupil edge midway in head length. Mouth small, short and horizontal, gape about three-fifths to eye. Lips thin, narrow. Mandible profile slightly concave to articulation below, which is opposite front pupil edge. Mouth protractile downward. Teeth very small, weak, uniform, brushlike, single row in each jaw. No teeth on mouth roof or on tongue. Inner buccal folds rather narrow. Tongue thick, fleshy, adnate. Maxillary hangs down from preorbital about two-thirds an eye diameter below eye, its expension 4 in eye. Nostrils together, close before eye, about level with upper pupil edge. Interorbital concave. Two short sharp-pointed spines above nostrils. Supraocular ridge finely serrated. Lower preopercle edge well serrated, largest serrae posterior and hind edge entire. Supraocular spine almost meets spine of predorsal process.

Gill-opening extends forward nearly opposite eye center. Gill-rakers, 8+22, slightly longer than filaments, or 3 in eye. Pseudobranchiae slightly longer than gill-filaments. Shoulder girdle edge within gill-opening with two firm low processes, upper trifle above and lower level with bases of lower pectoral rays. Isthmus width about 2¼ in eye.

Scales small, narrowly imbricated, caducous, entirely cover chest. Well-developed scaly sheaths along bases of spinous dorsal and anal. Soft dorsal and anal with series of inconspicuous spines each side basally, fin ray between each pair and all directed evenly backward. Axillary scaly ventral flap three-fifths of fin, three-fourths length of spine. Caudal base finely scaled. Abdomen narrowly compressed, lower face of preanal spine with median groove, forward about last two-fifths in space between ventral and anal origins. Chest with firm median keel. Two small keels extend forward from ventral bases, parallel. Lateral line convex, extends to caudal base. Tubes simple, well exposed, and largely continuous.

Spinous dorsal inserted opposite pectoral origin, second spine longest, others graduated down behind to uniformly low soft dorsal. Spinous anal inserted midway between snout tip and caudal base, first spine little less than third of second and third but slightly shorter. Soft anal like soft dorsal. Caudal well forked, pointed lobes about equal. Pectoral pointed, reaches third anal spine base. Ventral origin below that of pectoral, fin five-sixths to anal. Front basal edges of third dorsal and anal spines finely serrated.

Color in alcohol largely pale brownish, with blue-gray reflection on back. Latter also with number of deeper gray-brown vertical bars or streaks. Snout and interorbital dusted with deep brown dots, finer on occiput. Sides, lower surface, and iris silvery-white. Upper two-thirds of spinous dorsal over first three membranes jet black, rest of fin, together with others, pale brown. Slaty-gray line parallel with dorsal base close below basal spinous joints. Pectoral axil dusted with brown dots.

Length of largest, 80 mm.

Three examples. Takao.

We have compared Sumatran examples in the Academy and found all in agreement.

LEIOGNATHUS LEUCISCUS (Gunther).

Head, 3½ to 3⅝; depth, 2¾ to 2⅘; D. VIII, 16; A. III, 14; snout, 2⅞ to 3 in head; eye, 3 to 3⅛; maxillary, 2⅗; to 2½; interorbital, 2¾ to 2⅘. Preopercle smooth. Gill-rakers, 7 or 8+11 to 13. Second dorsal spine little greater than body depth, or 2⅗ in combined head and trunk without caudal. Color in alcohol, back vinaceous-gray or bluish-gray, with brown tinge in some lights, mottled with deeper or brownish specks or blotches. Sides and lower surface silvery-white. Snout edge blackish-brown. Iris white. Fins pale brownish. Seven examples, 68 to 135 mm. Takao.

L. edwardsi Evermann and Seale[24] we think a synonym. The characters of distinction, such as the smooth preopercle, supraocular spine, and less developed first dorsal spine are hardly of specific value, and all are covered by our examples.

Quite likely *L. stercorarius* Evermann and Seale[25] may be another synonym. A comparison of the paratype in the Academy shows no characters worthy of distinction from our series, as the prolonged second dorsal spine is quite variable.

GAZZA ARGENTARIUS (Schneider).

Head, $2\frac{3}{5}$ to 3; depth, $2\frac{1}{5}$ to $2\frac{3}{5}$; D. VIII, 16; A. III, 14; snout, $3\frac{1}{8}$ to $3\frac{3}{5}$ in head; eye, $3\frac{1}{10}$ to $3\frac{1}{8}$; maxillary, $3\frac{7}{8}$ to 4; interorbital, $2\frac{7}{8}$ to $3\frac{1}{8}$. Gill-rakers, 5+15, lanceolate, slightly longer than filaments, or about 2 in eye. Color in alcohol, back bluish-gray, with vertical lines, often broken, as specks or bars. Upper jaw edge dusky-brown. Spinous dorsal dusky. Other fins pale brown. Side, lower surface, and iris silvery-white. Pectoral axil dusky. Length, 115 to 130 mm. Five from Takao.

Our examples agree entirely with Sumatran and Philippine material in the Academy reported as *G. tapeinosoma* Bleeker.

Family CHEILODIPTERIDAE.

AMIA BIFASCIATA (Rüppell).

Head, $2\frac{1}{2}$; depth, $2\frac{3}{4}$; D. VII—I, 9, i; A. II, 8, i; tubular scales about 19 in lateral line to caudal base and 4 more on latter; 2 scales above lateral line to soft dorsal origin, 7 below to spinous anal origin; 5 predorsal scales; snout, $3\frac{7}{8}$ in head from upper jaw tip; eye, $3\frac{1}{10}$; maxillary, $2\frac{1}{5}$; interorbital, 5. Gill-rakers iii, 3+9, iv, lanceolate, seven-eighths of filaments, or 4 in eye. Scales with 13 to 17 basal radiating striae, often 2 or 3 incomplete auxilliaries, apical denticles 70 to 121, and circuli moderate. First and second membranes of spinous dorsal blackish, others dusky, also soft dorsal. Blackish caudal blotch basally, little smaller than eye. Length, 105 mm. Cebu.

Compared with a Philippine example in the Academy. The median brown longitudinal band from the snout tip nearly to caudal base present in both, though less conspicuous in the Cebu example, doubtless on account of its poor preservation. A larger example of *Apogon snyderi* Jordan and Evermann, from the Hawaiian Islands, in the Academy agrees in every way and indicates that nominal species to be a synonym.

AMIA SEALEI Fowler.

Head, $2\frac{3}{5}$; depth, 3; D. VII—I, 9, i; A. II, 8, i; tubular scales, about 21 in lateral line to caudal base and 4 more on latter; 3 scales above lateral line to soft dorsal origin; 3 predorsal scales; snout 4⅒ in head from upper jaw tip; eye, 3; maxillary, 2⅓; interorbital, 4½. Gill-rakers, II. 3+11, IV, lanceolate, filaments seven-eighths of gill-rakers, which 3 in eye. Scales with 14 to 18 basal radiating striae, 128 to 148 apical denticles, and circuli coarse. Dorsals dusted with dull brownish. At upper caudal base small deep brown round spot, little less than pupil. Length, 98 mm. (caudal damaged). Cebu.

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[24] Bull. Bur. Fish., vol. 26, 1906 (1907), p. 68, fig. 7. San Fabian, Philippines.

[25] Idem, p. 67, fig. 6. Bulan.

We compared this example, though poorly preserved and much larger, finding it agrees with the types in the Academy.

AMIA LINEATA (Schlegel).

Head, 2⅓ to 2½; depth 2¾ to 3; D. VII—I, 9, I; A. II, 8, I; tubular scales, 20 in lateral line to caudal base and 4 more on latter; 2 scales above lateral line to soft dorsal origin, 5 below to spinous anal origin; 5 predorsal scales; snout, 5 to 5½ in head; eye, 3⅕ to 3½; maxillary, 1¾ to 2; interorbital, 3¼ to 3⅞. Gill-rakers II, 3+11, lanceolate, twice filaments, or 2 in eye. Scales with 10 to 16 basal radiating striae, 2 or 3 auxiliaries, apical denticles 93 to 104, and circuli rather fine. Color in alcohol with ten pale brown vertical bars, wide or narrower as whitish interspaces on trunk. Back pale brown. Dorsals and caudal dusted with blackish dots, more crowded and darker marginally or terminally. Pale subbasal dusky band on soft dorsal. Anal pale, dusted with blackish marginally. Paired fins pale. Length, 38 to 75 mm. Eight from Takao.

An example in the Academy from Nagasaki compared and agrees. We believe the narrower vertical dark bands described by Jordan and Snyder are largely due to conditions of preservation. Our specimens, which are much fresher, at least in appearance, show more dark pigment dots under a lens and the dark areas they form are of greater extent. No structural differences can be found.

AMIA ELLIOTI (Day).

Head, 2⅓ to 2⅖; depth, 3¼ to 3⅖; D. VII—I, 9, I; A. II, 8, I; tubular scales 22 in lateral line to caudal base and 4 more on latter; 2 scales above lateral line to spinous dorsal origin, same to soft dorsal origin, 6 below to spinous anal origin; 4 or 5 predorsal scales; snout 5 to 5⅓ in head from upper jaw tip; eye, 3⅖ to 3⅗; maxillary 2; interorbital, 3¼ to 4⅖. Gill-rakers III, I+9, III, lanceolate, filaments four-fifths of gill-rakers, which 2⅓ in eye. Scales with 11 or 12 basal radiating striae, often 1 to 4 auxiliaries incomplete, apical dentricles 69 to 83 and circuli coarse. Color in alcohol dull brown with silvery reflections. Seven broad brown vertical bands, pale interspaces one-third width of bands. Iris slaty, with coppery tints. Upper half of spinous dorsal black, basal half white. Soft dorsal white, with margin and median horizontal band black. Caudal with submarginal dusky band behind. Length, 91 to 100 mm. Four from Takao.

Jordan and Snyder place *Apogon marginatus* Döderlein as a species distinct from the present. As *Apogon ellioti* Steindachner, however, originally records the species correctly from Kagoshima and Kobi. Jordan and Snyder had but a single example, obtained at Wakanoura. All of our examples show the preopercle ridge with a blackish line.

AMIA KIENSIS (Jordan and Snyder).

Head, 2½ to 2¾; depth, 2⅞ to 3¼; D. VII—I, 9, I, or 10, I; A. II, 8, I; tubular scales, 23 or 24 in lateral line to caudal base, and 2 to 4 more on latter; 2 scales above lateral line to soft dorsal origin, 6 below to spinous anal origin; 4 or 5 predorsal scales; snout, 4⅛ to 4⅜ in head from upper jaw tip; eye, 3 to 3½; maxillary, 1⅞ to 2; interorbital, 4⅓ to 4½. Gill-rakers III, 3+11, III, lanceolate, one third longer than filaments, or 2¼ in eye. Scales with 13 to 17 radiating basal striae, apical denticles 112 to 116, and circuli rather few. Color in alcohol pale brown above, paler to whitish beneath, with silvery reflections, especially on opercle. Narrow deep brown line, not wide as pupil, from snout tip to caudal base and out over fin to its hind edge. Another, similar, parallel, begins above eye and ends on upper surface of caudal peduncle. Outer dorsal edges dusted with dusky. Both soft dorsal and anal with dusky line subbasally.

In very small brightly colored examples, upper dark lines arise at snout tip, extend over eye, and finally disappear at caudal. Also these show an additional median dark predorsal line arising over middle of eye and a paler one from upper hind eye edge, between supradorsal and mediolateral bands. It is much less conspicuous, only indicating the lateral line and not extending beyond soft dorsal. Length, 45 to 90 mm. Twenty-four examples from Takao.

Compared with a Philippine example in the Academy and agrees.

Family PRIACANTHIDAE.

PRIACANTHUS TAYENUS Richardson.

Head, 2⅘ to 3; depth, 2⅔ to 2⅘; D. X, 12, I; A. III, 13, I; scales 70 along lateral line to caudal base and 5 more on latter, 10 scales above lateral line to spinous dorsal, 9 above to soft dorsal origin, 30 below to spinous anal; 43 predorsal scales; snout, 3⅘ to 3¾ in head from upper jaw tip; eye, 2 to 2¼; maxillary, 1⅘ to 1⅞; interorbital, 4⅕ to 4⅓. Gill-rakers, 4+18, lanceolate, one-fourth longer than filaments, or 2¾ in eye. Scales with four basal lobes, irregular apical denticles 12 to 20, and circuli moderate. Soft dorsal ends in point reaching middle of caudal. Caudal emarginate, lobes end in rather long points. Color in alcohol faded pale brown, pale or whitish below, sides silvery-white. Fins pale, spinous dorsal edge, upper soft dorsal marginally, lower anal edge and hind caudal edge dusky. Ventral white, membranes spotted finely with dusky to blackish and innermost membranes marginally with large black blotch. Length, 147 to 180 mm. Three from Takao.

PRIACANTHUS MACRACANTHUS Cuvier.

Head, 3; depth, 2¾; D. XI, 13, I; A. III, 14, I; scales, 94 along lateral line to caudal base and 7 more on latter; tubular scales in lateral line 62 to caudal base and 5 more on latter; 10 scales above lateral line to spinous dorsal origin, 12 to soft dorsal origin, 39 below to spinous anal origin; 50 predorsal scales; snout, 3½ in head from upper jaw tip; eye, 2½; maxillary, 2; interorbital, 3⅓. Gill-rakers, 5+18, lanceolate, equal filaments, or 3 in eye. Scales with four basal lobes, irregular apical denticles 20 to 23, and circuli fine. Caudal truncate. Color in alcohol dull brown above, pale below, with silvery reflections. Fins with dull ground color, spinous dorsal tinged dusky. Soft dorsal, anal, and caudal finely lined or streaked with dusky. Ventral pale, marked with few dusky dots. Length, 213 mm. Zamboanga.

PRIACANTHUS HAMRUR (Forskål).

Head, 3; depth, 3; D. X, 13, I; A. III, 14, I; scales, 93 along lateral line to caudal base and 6 more on latter; tubular scales 74 in lateral line to caudal base and 6 more on latter; 12 scales above lateral line to spinous dorsal origin, 10 to soft dorsal origin, and 30 below to spinous anal origin; predorsal scales, 55; snout, 3¾ in head from upper jaw tip; eye, 2½; maxiallary, 2; interorbital, 4⅛. Gill-rakers III, 8+18, lanceolate, one-fifth longer than filaments, or 3 in eye. Scales with four basal lobes, 15 to 24 irregular apical denticles, and circuli moderate. Fins not produced, hind caudal edge emarginate. Color in alcohol pale brown, silvery-white below. Spinous dorsal with pale dusky tinge marginally. Ventral largely whitish, membranes dusted with dusky, more intense marginally. Length, 183 mm. One from Takao.

Family, SERRANIDAE.

EPINEPHELUS SUMMANA (Forskål).

Heal, 2⅗ to 2⅔; depth, 2⅘ to $2\frac{9}{10}$; D. XI, 16, I; A. III, 8, I; scales, 98 to 100 in lateral line to caudal base, tubular scales, 53 or 54; 13 or 14 scales above lateral line to soft dorsal origin, 33 or 34 below to spinous anal origin; 90 or 92 predorsal scales; snout, about 4¾ to 5 in head from upper jaw tip; eye, about 4⅓ to 4⅕; maxillary, 2¼ to 2⅗; interorbital, 6⅕ to 8. Rakers vi, 2+10, v, lanceolate, equal filaments, or 2⅓ in eye. Teeth triserial along middle of lower jaw laterally. Preopercle edge finely serrate. Scales with 4 or 5 basal radiating striae, moderately numerous apical denticles rather slender, and circuli rather coarse. Maxillary half scaled apically above. Caudal rounded. Color in alcohol back gray-brown, belly and under surface pale to light brownish-drab. Above and on sides many small crowded and mostly rounded gray-white spots or bars, often broken and irregular, much smaller on head. Under surface of head, breast and belly nearly uniform. Fins dusky, with many minute pale or gray-white crowded dots and spots. Edges of soft dorsal, anal and caudal narrowly whitish. Length, 245 to 252 mm. Two from Zamboanga.

EPINEPHELUS FUSCOGUTTATUS (Forskål).

Head, 2⅓; depth, 3; D. XI, 14, I; A. III, 8, I; scales, 104 in lateral line to caudal base, tubular scales about 55 and about 8 more on caudal basally; 16 scales above lateral line to soft dorsal origin, 35 below to spinous anal origin; 82 predorsal scales; snout 4⅔ in head from upper jaw tip; eye, 6⅗; maxillary, 2; interorbital, 6⅔. Gill-rakers III, 3+10, VII, lanceolate, three-fourths of filaments, which 1⅗ in eye. Mandible with 3 lateral series of teeth. Preopercle edge finely serrated. Scales with 6 to 9 basal radiating striae, often 2 or 3 more auxiliaries, small weak apical denticles clustered as little patch subapically, and circuli rather coarse. Maxillary with upper half of apical expansion finely scaled. Caudal rounded. Color in alcohol with back warm sepia with deeper to dusky-brown marblings. Two dark or dusky predorsal blotches, four at dorsal base and black saddle on middle of caudal peduncle above. Four transverse dark-brown blotches across mandible. Body most everywhere with small ill-defined dark spots, crowded and numerous on head. Dark blotches along dorsal base extending up on fin. Spinous dorsal with margin of each membrane blackish. Soft dorsal, anal, and caudal and paired fins with large deep brown blotches, more or less as transverse rows. Length, 218 mm. One from Cebu.

EPINEPHELUS MERRA Bloch.

One from Zamboanga, 78 mm. long. Two rows of teeth along each side of lower jaw. Gill-rakers, v, 3+11, IV, lanceolate, longer than filaments, or 2½ in eye. No maxillary scales. Color in alcohol, body with large deep rounded dusky spots, nearly large as eye, smaller on fins and under surface of head. Narrow interspaces or reticulations pale or whitish, especially on under surface of body.

EPINEPHELUS AREOLATUS (Forskål).

Head, 2½; depth, 2⅞; D. XI, 16, i; A. III, 8, i; scales, 110 in lateral line to caudal base, tubular scales about 50 and 3 more on caudal base; 16 scales above lateral line to soft dorsal origin, 38 below to spinous anal origin; 67 predorsal scales; snout, 3⅘ in head from upper jaw tip; eye, 5¼; maxillary, 2⅓; interorbital, 6⅔. Gill-rakers 7+13, ii, lanceolate, 1¾ in eye, or slightly longer than filaments. Teeth biserial along sides of lower jaw. Preopercle edge finely serrate, produced at angle into 5 or 6 enlarged spines. Scales with 3 to 5 basal radiating striae, apical denticles in about 36 rows, and circuli complete. Maxillary two-thirds scaled apically above. Caudal emarginate. Color in alcohol with back deep brownish-drab, paler to nearly avellaneous on belly and lower surface. Vertical fins and ventrals dusky blackish. Body marked with large deep brownish-drab spots, though all smaller than eye. On fins all spots smaller, more numerous and crowded. Margin of soft dorsal narrowly pale to whitish, that of pectoral broadly so. Pectoral palest of fins. Length, 292 mm. Takao.

CROMILEPTES ALTIVELIS (Valenciennes).

Head, 2½; depth, 2¾; D. XI, 19; A. III, 10; scales, 102 in lateral line to caudal base, tubular scales 54, and 8 more on caudal base; 18 scales above lateral line to soft dorsal origin, 40 below to spinous anal origin; about 70 predorsal scales; snout, 4½ in head from upper jaw tip; eye, 5⅔; maxillary, 2⅓; interorbital, 9⅓. Gill-rakers, vi, 1+9, v, lanceolate, 1¾ in gill-filaments, which 2 in eye. Scales with 6 or 7 basal radiating striae, small weak apical denticles few or absent, and circuli moderate. Color in alcohol nearly pale purple-drab, spotted sparsely, though evenly, with dusky-brown. Spots became much smaller on front of head, largest on back, not quite size of eye. Pectoral and ventral become dusky terminally, with rather numerous dusky spots. Length, 178 mm. Cebu.

Family LUTJANIDAE.

LUTJANUS KASMIRA (Forskål).

Head, 2⅔; depth, 2⅔; D. XI, 13, i; A. III, 7, i; scales, 85 in lateral line to caudal base, tubular scales 50, and 7 more on caudal base; 8 scales above lateral line to soft dorsal origin, 21 below the spinous anal origin; 13 predorsal scales to occiput; snout, 3⅓ in head from upper jaw tip; eye, 3¾; maxillary, 2⅔; interorbital, 5. Gill-rakers, 7+13, iv, lanceolate, slightly less than filaments, or 3 in eye. Preopercle with deep notch, serrae strong below and around angle. Scales with 9 basal radiating striae, apical denticles 70 to 84, and circuli extremely fine. Color in alcohol, back dull brown, below much lighter. Four blue-gray horizontal bands, lowest median, above pectoral axil to caudal base medianly and widest, each with dark marginal line. Fins all pale. Length, 173 mm. Zamboanga.

LUTJANUS VITTA (Quoy and Gaimard).

Head, $2\frac{3}{4}$ to $2\frac{4}{5}$; depth, $2\frac{3}{5}$ to $2\frac{4}{5}$; D. X, 13, I; A. III, 8, I; scales, 53 to 60 in lateral line to caudal base, tubular scales 50 and 5 more on caudal base; 7 scales above lateral line to soft dorsal origin, 16 or 17 below to spinous anal origin; 13 to 16 predorsal scales to occiput; snout, 3 to $3\frac{1}{5}$ in head from upper jaw tip; eye, $4\frac{3}{5}$; maxillary, $2\frac{3}{5}$ to $2\frac{1}{2}$; interorbital, $4\frac{1}{2}$ to 5. Often slight notch on hind preopercle edge above angle. Gill-rakers, v, 1+9, III, to 11, II, lanceolate, about seven-eighths of filaments, or 2 in eye. Scales with 11 to 14 basal radiating striae, apical denticles 90 to 127, and circuli extremely fine. Color in alcohol, dull brussels-brown on back to lateral line, below pale orange-yellow. Each row of scales above lateral line with dark median line following courses of scales, thus oblique after curve of lateral line. Below lateral line pale horizontal lines like those above, fading on belly. Fins dull brownish, like back. Anal, pectoral, and ventral pale like lower surface of body. Length, 223 to 295 mm. Two examples, from Cebu and Takao, respectively.

Dark median dusky olive band from snout tip to base of upper caudal lobe, in larger example expanded slightly as in Bleeker's *Mesoprion ophuysenii* below front of soft dorsal.

LUTJANUS MALABARICUS (Schneider).

Head, $2\frac{1}{2}$; depth, $2\frac{1}{4}$; D. XI, 14, I; A. III, 9, I; scales, 60 in lateral line to caudal base, tubular scales 46 and 7 more on caudal base; 10 scales above lateral line to soft dorsal origin, 20 below to spinous anal origin; 12 predorsal scales; snout, $2\frac{2}{3}$ in head; eye, $5\frac{1}{5}$; maxillary, $2\frac{3}{5}$; interorbital, 6. Preopercle with very slight notch above angle. Gill-rakers, v 2+11, IV, lanceolate, little longer than filaments, or $1\frac{2}{3}$ in eye. Scales with 18 to 21 basal radiating striae, apical denticles 83 to 86, and circuli very fine. Color in alcohol with back nearly dull avellaneous, sides and below pale to silvery-white. Along each row of scales medianly very slightly darker streak. Upper edge of caudal peduncle with white blotch below last dorsal rays, adjoins an olive-brown saddle, behind which at caudal base slightly paler blotch. Fins pale. Upper dorsal and hind caudal edges slightly dusky-gray. Length, 253 mm. Takao.

LUTJANUS DECUSSATUS (Cuvier).

Head, 2⅘; depth, 2⅗; D. X, 13, I; A. III, 8, I; scales, 60 in lateral line to caudal base, tubular scales 50; 8 scales above lateral line to soft dorsal origin, 14 below to spinous anal origin; 13 predorsal scales to occiput; snout, 3⅕ in head; eye, 4⅖; maxillary, 2⅖; interorbital, 5⅕. Preopercle with shallow notch above angle. Gill-rakers VI, 1+7, IV, lanceolate, equals filaments, or 2⅕ in eye. Scales with 12 to 14 radiating basal striae, apical denticles 72 or 73, and circuli extremely fine. Color in alcohol, back dull brown, pale below. Five longitudinal pale brown bands. On back across upper three seven vertical dark streaks. Blackish blotch size of eye at caudal base medianly. Fins all dull brown. Length, 115 mm. Cebu.

LUTJANUS FULVIFLAMMA (Forskål).

Head, 2½ to 2⅔; depth, 2¾; D. X, 12, I or 13, I; A. III, 8, I; scales, 49 to 54 in lateral line to caudal base, tubular scales 44 to 47, and 5 to 8 more on caudal base; 7 or 8 scales above lateral line to soft dorsal origin, 11 to 14 below to spinous anal origin; 10 to 14 predorsal scales to occiput; snout, 3⅕ to 3⅓ in head; eye, 3⅞ to 4; maxillary, 2⅕ to 2½; interorbital, 4⅗ to 5⅓. Preopercle with shallow notch above angle, latter well denticulated. Gill-rakers IV to VI, 1 or 2+9, IV, lanceolate, nearly long as filaments, or 2 in eye. Scales with 10 to 12 basal radiating striae, apical denticles 67 to 92, and circuli very fine. Color in alcohol, back drab-gray to natal-brown on head above. Sides and lower surface whitish. Ellipsoid dusky-brown blotch, obscurely defined, on lateral line, longer than eye and below front of soft dorsal. Obscure pale yellowish lines, oblique above and horizontal below lateral line, one medianly in each scale course. Length, 126 to 156 mm. Two from Zamboanga and two from Cebu.

LUTJANUS SEBAE (Cuvier).

Head, 2⅗; depth, 2⅕; D. XI, 15, I; A. III, 10, I; scales about 66 in lateral line to caudal base, tubular scales 50, and 5 more on caudal base; 10 scales above lateral line to soft dorsal origin, 24 below to spinous anal origin; 15 predorsal scales to occiput; snout, 2⅓ in head; eye, 5⅕; maxillary, 3; interorbital, 5⅗. Preopercle edge notched above angle. Gill rakers, V, 1+8, IV, lanceolate, equal filaments, or 2⅕ in eye. Scales with 9 to 15 basal radiating striae, apical denticles 70 to 82 and circuli very fine. Color in alcohol, generally nearly ivory-yellow. Broad oblique dark sepia band along side of snout to spinous dorsal origin. Another transversely from front of spinous dorsal to behind pectoral base, then obliquely till before spinous anal origin. Third band from last dorsal spines obliquely back and broadly over caudal peduncle to end of lower caudal lobe. End of upper caudal lobes and ventral blackish. Upper edges of soft dorsal and lower edges of soft anal white with black submarginal band. Length, 210 mm. Zamboanga.

Family THERAPONIDAE.

THERAPON JARBUA (Forskål).

Head, 3⅛; depth, 2⅜; D. XII, 10, I; A. III, 9, I; scales, 100 in lateral line to caudal base, tubular scales 90, and 4 more on caudal base; 15 scales above lateral line to soft dorsal origin, 18 above to spinous dorsal origin, 30 below to spinous anal origin; 25 predorsal scales; snout, 3⅓ in head; eye, 4⅜; maxillary, 2⅜; interorbital, 3. Gill-rakers 7+14, short thick strong points, 1⅔ in filaments, which 1½ in eye. Scales with 10 to 12 basal radiating striae, apical denticles 16 to 24, and circuli moderately coarse. Color in alcohol, dull brownish above, with some light blue-green reflections. Lower surface whitish. Body marked everywhere with bright silvery-white. Fins all pale. Spinous dorsal with large black blotch on upper three-fifths of front elevation and another on last three spines. Smaller black blotches, three on soft dorsal marginally. Above and behind suprascapula large dusky blotch, little larger than eye. Three parallel longitudinal dark or dusky-brown bands on back, upper close along dorsal bases, second begins as broad dark blotch on predorsal narrowing along lateral line and reflected obliquely across upper caudal lobe. Lowest band from below suprascapula, back medianly to caudal, extends medianly over caudal fin to its edge. Except upper tip of caudal fins otherwise pale. Length, 252 mm. Takao.

THERAPON QUADRILINEATUS (Bloch).

Head, 3¼ to 3⅔; depth, 2⅔ to 3⅛; D. XII, 10, I; A. III, 10, I; scales, 80 to 92 along close above lateral line to caudal base, tubular scales in lateral line 63 to 67, and 6 to 8 more on latter; 13 to 15 scales above lateral line to soft dorsal origin, 14 to 16 above to spinous dorsal origin, 22 to 26 below to spinous anal origin; snout, 2¾ to 3 in head; eye, 3⅓ to 4; maxillary, 3⅓ to 3½; interorbital, 3½ to 3⅞. Gill-rakers, 17+22 or 23, lanceolate, slightly less than filaments, which 2 in eye. Scales with 7 to 18 basal radiating striae, apical denticles 16 to 30, and circuli coarse. Color in alcohol, dull brownish above, pale below, most of body overshot with silvery reflections. Spinous dorsal with blackish edge and black elevated blotch forward. Soft dorsal and anal largely dusky marginally, also caudal. Four longitudinal deep brown parallel bands, uppermost from hind interorbital to front of soft dorsal basally, and second from above nostrils to soft dorsal base medianly. Third band from snout tip through eye to base of upper caudal lobe and lowest from pectoral axil to lower caudal lobe medianly, though obscure. Large dark brown round spot above and behind suprascapula rests on inception of lateral line. Length, 117 to 163 mm. One from Cebu and two from Takao.

Our smallest example without the large dark blotch above suprascapula, though there are four longitudinal dark lines or bands above front of lateral line. Also another, indistinct, along each side of body.

Family HAEMULIDAE.

PLECTORHINCHUS PALYTAENIA (Bleeker).

Head, 3¼ to 3⅖; depth, 2⅝ to 2⅞; D. XII or XIII, 21, I; A. III, 7, I; 102 or 103 scales counted along close above lateral line to caudal base; 59 or 60 tubular scales in lateral line to caudal base and 9 more on latter; 16 or 17 scales above lateral line to soft dorsal origin, 21 below to spinous anal origin; 50 to 57 predorsal scales; snout, 2⅓ to 2⅖ in head; eye, 3½ to 4; maxillary, 2⅞ to 3; interorbital, 3⅔ to 3⅞. Gill-rakers, 10+18, lanceolate, 1⅔ in filaments, which 1⅔ in eye. Scales with 3 or 4 basal radiating striae, apical denticles, 52 to 62, and circuli very fine. Color in alcohol, pale brownish, generally with nine white longitudinal lines, broadest along middle of side. Between white lines each brown line or band narrowly bordered with darker. Fins uniform dull brown. Iris yellowish. Length, 295 to 301 mm. Two from Zamboanga.

PLECTORHINCHUS GOLDMANNI (Bleeker).

Head, 3⅓; depth, 2¾; D. XIII, 19, I; A. III, 7, I; scales, 95 counted close above along lateral line to caudal base, tubular scales 58, and 18 more on latter; 14 scales above lateral line to soft dorsal origin, 21 below to spinous anal origin; 62 predorsal scales; snout, 2½ in head; eye, 3⅛; maxillary, 3⅛; interorbital, 3⅗. Gill-rakers, 8+20, lanceolate, 2 in filaments, which 1¾ in eye. Scales with 5 basal radiating striae, apical denticles 42 to 50, and circuli very fine. Color in alcohol, pale brownish generally. Six deep blackish-brown longitudinal bands on back, lowest from pectoral axil and less distinct. Spinous dorsal whitish, with two rows of blackish spots, one row marginal and other median. Soft dorsal with two or three irregular rows of smaller blackish spots. Soft anal and caudal with black spots, larger on latter. Pectoral and ventral dull brown. Iris pale olive-slate. Length, 218 mm. Cebu.

Our example without the black spot at pectoral base indicated in Bleeker's figure, or the two longitudinal dark lines below the base of same fin, as he shows.

PLECTORHINCHUS PUNCTATUS (Rüppell).

Head 3; depth, 2⅔; D. X, 24, I; A. III, 7, I; tubular scales, 57 in lateral line to caudal base and 12 more on latter; 13 scales above lateral line to soft dorsal origin, 17 above to spinous dorsal origin, 20 below to spinous anal origin; 62 predorsal scales; snout, 2⅔ in head; eye, 3½; maxillary, 3; interorbital, 4. Gill-rakers, 6+13, lanceolate, 2¼ in filaments, which 1⅔ in eye. Scales with 6 to 8 basal radiating striae, apical denticles 30 to 46, and circuli moderate. Color in alcohol, largely olive-brown, little paler on breast and belly below, back, and sides, with irregular large close-set spots of slightly darker color than general body color. Dorsals with similar large blackish close-set spots, also caudal, ventral, and anal blackish. Pectoral pale brown. Length, 145 mm. Cebu.

Agrees largely with Day's figure, except it does not show the dark circles on lower and posterior side of head.

PLECTORHINCHUS CHAETODONTOIDES (Lacépède).

Head, 2⅞; depth, 2⅛; D. XII, 19, I; A. III, 8, I; about 65 scales counted close along lateral line to caudal base, tubular scales 59, and 6 more on caudal base; 12 scales above lateral line to soft dorsal origin, 12 above to spinous dorsal origin; 52 predorsal scales; snout, 2¾ in head; eye, 3¼; maxillary, 3; interorbital, 3⅜. Gill-rakers, 10+24, lanceolate, half of filaments and latter 1¾ in eye. Scales with 5 or 6 basal radiating striae, with 1 to 4 auxilliaries, apical denticles 36 to 38, and circuli fine. Color in alcohol, dull brown generally, with pale blotch on snout and front of mandible. Another below eye over branchiostegal region and front of breast. One also from before pectoral base to that of ventrals. Pale blotch behind pectoral base, one at occiput, another on back includes hind dorsal spines. One above and at front of spinous anal and finally one obliquely over caudal peduncle. All these markings in dark area bordered slightly with narrow dark line. Fins dusky brown except for extension of pale blotch. Soft dorsal with two whitish obliquely longitudinal lines. Soft anal blackish, with little whitish blotch in front and behind, first spine largely pale. Caudal whitish, with blackish transverse band, also base of fin. Pectoral and ventral blackish. Length, 150 mm. Cebu.

Our example differs a little from Bleeker's figure of the young in that it has no dark round spots within the pale areas and its lower fins with more or less blackish. It has the predorsal and front spinous dorsal regions of the back uniformly dark, likewise the entire region of the soft dorsal and the region of the caudal base.

PLECTORHINCHUS PICTUS (Thunberg).

Head, 3; depth, 2½ to 2¾; D. X, 21, I, to 24, I; A. III, 7, I; about 95 to 98 scales counted close along and above lateral line to caudal base, tubular scales 54 to 68 and 11 to 14 more on caudal base; 14 to 16 scales above lateral line to soft dorsal origin, 19 or 20 above to spinous dorsal origin, and 21 to 23 below to spinous anal origin; 47 to 55 predorsal scales; snout, 2⅗ to 3 in head; eye, 3⅛ to 3⅓; maxillary, 2⅞ to $3\frac{1}{10}$; interorbital, 4⅛ to 4¼. Gill-rakers, 8+12 lanceolate, 1½ in gill filaments, which 2 in eye. Scales with 5 to 8 basal radiating striae, rather long and slender apical denticles 15 to 19, and circuli moderately coarse. Color in alcohol, blackish-brown above with white longitudinal lines or bands. Margin of dorsals white, broadly black basally. White median line from middle of predorsal forward, where broadening to snout end, forks to end line each side along front of back until about opposite base of ninth dorsal spine. From over eye white band back to last two dorsal rays along upper caudal peduncle edge, then obliquely over upper caudal lobe to its hind edge. Another white band parallel from lower eye edge includes pectoral base and extends similarly along lower caudal peduncle edge and fin lobe. Rest of under surface pale. Pectoral whitish. Ventrals and anals largely blackish. Length, 87 to 102 mm. Three from Takao and one from Cebu.

The three smaller examples, from Takao, largely resemble Bleeker's figure,[26] except the bands of our specimens are much more broadly white and contrasted. An indistinct dark longitudinal streak from below pectoral base to beginning of caudal peduncle, not shown by Bleeker. Our examples with more blackish on soft anal, also outer terminal caudal edges blackish and basal front of spinous dorsal white. Our largest example differs in the marginal dark band of the back broken into five dark blotches.

POMADASIS HASTA (Bloch).

Head, 3; depth, 2⅕; D. XII, 14; A. III, 7, I; tubular scales 51 in lateral line to caudal base and 9 more on latter; 4 scales above lateral line to soft dorsal origin, 7 above to spinous dorsal origin, 10 below to spinous anal origin; 13 predorsal scales to occiput and 24 more forward on cranium; snout, 3 in head; eye, 5⅔; maxillary, 3⅔; interorbital, 3⅘. Gill-rakers, 5+11, lanceolate, short, 2½ in gill-filaments, which 1⅗ in eye. Scales with 9 or 10 radiating basal striae, apical denticles 70 or 71, and circular fine. Color in alcohol, dull olive-brown above, paler below. On back and predorsal about seven irregular series of deep brown spots continue back until only half as many rows below soft dorsal. Dorsals dull gray-brown with four longitudinal rows of blackish spots. Caudal and soft anal with dusky tints, otherwise fins pale. Length, 262 mm. Takao.

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[26] Atlas Ichth., vol. 8, 1876–77, pl. 55 (333), fig. 2.

POMADASIS MACULATUS (Bloch).

Head, 3 to 3⅛; depth, 2⅗ to 2¾; D. XII or XIII, 13, i, or 14, i; A. III, 7, i; tubular scales 50 or 52 in lateral line to caudal base and 8 to 10 more on latter; 5 scales above lateral line to soft dorsal origin, 8 or 9 above to spinous dorsal origin and 13 or 14 below to spinous anal origin; 30 to 38 predorsal scales. Gill-rakers, 4 or 5+14, lanceolate, 2¼ in gill-filaments, which 1¾ in eye. Scales with 9 to 14 basal radiating striae, apical denticles 48 to 73, circuli fine. Color in alcohol with back saccardo-umber, sides and below paler to whitish. Back with four obscure deep dusky vertical broad bands, often broken above where more or less alternate, and scarcely extending below level of eye. Spinous dorsal largely dusky to blackish. Caudal and soft dorsal paler. Dorsal and anal spines burnished with silvery. Other fins like belly. Oblique short dusky line below nostril. Length, 51 to 220 mm. Seven from Takao.

Family SPARIDAE.

NEMIPTERUS MULLOIDES (Bleeker).

Head, 3⅛ to 3¾; depth, 3 to 4; D. X, 9, i; A. III, 7, i; tubular scales 45 to 48 in lateral line to caudal base and 2 more on latter; 3 scales above lateral line to soft dorsal origin, 4 above to spinous dorsal origin, 10 below to spinous anal origin; 12 or 13 predorsal scales; snout, 2½ to 4 in head; eye, 2¾ to 3½; maxillary, 2⅜ to 2⅘; interorbital, 3½ to 5. Gill-rakers, 3+6 short broad tubercles, much shorter than filaments, which 1¾ in eye. Scales with 7 to 11 basal radiating striae, often 2 or 3 incomplete, apical denticles 96 to 102, and circuli very fine. Color more or less faded dull uniform brownish in alcohol, paler below and with silvery reflections. Length, 68 to 255 mm. Seventeen from Takao.

This species appears to be known previously only from Sumatra, and its occurrence in Formosa is therefore of interest. A comparison with Bleeker's figure shows our specimen with slightly shorter dorsal spines, though all with the marginal membranes deeply incised. In appearance the squamation is quite compact, so that the specific name is certainly well selected with reference to the general resemblance to certain of the goat-fishes.

GYMNOCRANIUS LETHRINOIDES (Bleeker).

Head, 2⅞ to 3; depth, 2½; D. X, 10; A. III, 10, i; tubular scales 47 or 48 in lateral line to caudal base and 2 or 3 more on latter; 6

scales above lateral line to soft dorsal origin, 8 above to spinous dorsal origin, 15 or 16 below to spinous anal origin; 14 or 15 predorsal scales; snout, 2⅗ to 2⅘ in head; eye, 2⅕ to 3; maxillary, 3⅕ to 3¼; interorbital, 3⅓ to 3⅗. Gill-rakers, 5+5, short low tubercles; gill-filaments, 2¾ in eye. Scales with 15 or 16 basal radiating striae, 65 to 97 blunt apical denticles and circuli moderately fine. Color in alcohol, back brown, lower surfaces whitish. About five or six rather irregular narrow vertical cross bands of darker brown than body color. Dorsals with two longitudinal dark bands or lines and each caudal lobe with fine transverse dark bands. Other fins pale. Length, 207 to 210 mm. Two from Zamboanga.

CAESIO LUNARIS Cuvier.

Head, 3 to 3⅓; depth, 2½ to 2¾; D. X, 13, I; A. III, 9, I; tubular scales 48 to 50 in lateral line to caudal base and 6 more on latter; 7 scales above lateral line to soft dorsal origin, 14 below to spinous anal origin; 24 or 25 predorsal scales; snout, 3⅗ to 4 in head; eye, 2⅘ to 3⅕; maxillary, 2⅘ to 3; interorbital, 3½ to 4. Gill-rakers, 11+23, lanceolate, 1½ in eye; gill-filaments, four-fifths of gill-rakers. Scales with 12 to 15 basal radiating striae, pointed apical denticles 60 to 70, and circuli fine. Color in alcohol with black dusky-drab, paler on sides and whitish on under surfaces. Dorsals dusky, other fins pale, except deep brownish axillary blotch of pectoral. Mandible tip brownish like maxillary. Length, 143 to 150 mm. Six from Zamboanga.

Our examples differ from Bleeker's figure and account in that the caudal tips are not blackish, but pale like the rest of the fin.

CAESIO COERULAUREUS Lacépède.

Head, 3⅘; depth, 3⅓; D. X, 15, I; A. III, 12, I; tubular scales 60 in lateral line to caudal base and 6 more on latter; 7 scales above lateral line to soft dorsal origin, 14 below to spinous anal origin; 24 predorsal scales; snout, 3⅗ in head; eye, 4⅓; maxillary, 3; interorbital, 2⅕. Gill-rakers, 11+26, lanceolate, 1⅓ in filaments or 1⅗ in eye. Scales with 11 to 17 basal radiating striae, tuberculate apical denticles 83 to 70 and circuli fine. Color in alcohol faded olivaceous above to pale brown below. Beginning over eye and following along lateral line close above, obscure dull olive band, 2½ scales wide and bordered narrowly above and below slightly darker than general color of back. Dorsals like back. Caudal with median portion of each lobe dull olive-dusky, borders all paler. Dusky blotch at pectoral origin, axil broadly dusky. Other fins all pale. Length, 205 mm. Cebu.

CAESIO PISANG Bleeker.

Head, 3⅓; depth, 4⅘; D. X, 14, I; A. III, 12; tubular scales, 62? in lateral line to caudal base and 5 more on latter; 6 scales above lateral line to soft dorsal origin; predorsal scales, 25?; snout, 4 in head from upper jaw tip; eye, 4; maxillary, 3; interorbital, 3⅞. Gill-rakers, 10+25, lanceolate, equal gill-filaments, or 1½ in eye. Scales with 12 basal radiating striae, moderately pointed apical denticles 68 to 77 and circuli fine. Cheek with 4 rows of scales. Color in alcohol faded nearly dark purplish-gray on back, sides and lower surface pale brownish. Iris slaty. Mandible and snout tips brownish. Dorsals gray-brown. Other fins all pale, tips of caudal lobes slightly dusky to blackish. Length, 140 mm. Cebu.

PTEROCAESIO MULTIRADIATUS Steindachner.

Head, 3⅗ to 3½; depth, 3¾ to 4; D. XII, occasionally XI, 20, I; A. III, 13, I; tubular scales 71 to 75 in lateral line to caudal base and 7 more on latter, occasionally 6; 7 scales above lateral line to soft dorsal origin, 15 or 16 below to spinous anal origin; predorsal scales 20 to 21 to occiput and 6 or 7 more forward on cranium; snout, 3⅘ to 4⅕ in head from upper jaw tip; eye, 3⅗ to 4; maxillary, 2⅞; interorbital, 3⅕ to 3⅓. Gill-rakers, 11+27, lanceolate, slightly less than gill-filaments or 1¾ in eye. Scales with 11 to 13 basal radiating striae, rather tuberculate apical denticles 53 to 58 and circuli fine. Color in alcohol, back dull olivaceous. From over eye olive band to suprascapula, along lateral line till below last dorsal rays when continued straight to base of upper caudal lobe. Above lateral line each scale with small dull bluish median basal spot, these forming longitudinal lines. From upper hind half of eye broad blue band back to caudal base medianly, four scales wide below spinous dorsal and narrowing posteriorly. Dorsals dusky-olive. Caudal with longitudinal dusky-brown band in each lobe, borders pale. Lower surface of body whitish, also fins, except axial and blotch at pectoral origin, which blackish. End of mandible brownish, like snout. Eye pale yellowish. Length, 134 to 140 mm. Four from Zamboanga.

This handsome species does not appear to have been noticed since Steindachner originally described it from Amboina. *Pterocaesio* Bleeker is here admited to generic rank, chiefly on account of the increased dorsal spines and rays. It is, however, more closely allied allied with *Caesio* than with *Pinjalo*.

PENTAPUS CANINUS (Cuvier).

Head, 3⅕ to 3¼; depth, 3 to 3⅓; D. X, 9, I; A. III, 7, I; tubular scales 48 in lateral line to caudal base and 7 or 8 more nontubular on latter; 3 scales above lateral line to soft dorsal origin, 11 below to spinous anal origin; 27 predorsal scales; snout, 2⅞ in head; eye, 3½ to 3⅔; maxillary, 2⅔; interorbital, 2⅞ to 3. Gill-rakers, 5+6, short tubercles, greatly less than gill-filaments, which 2 in eye. Scales with 8 to 13 basal radiating striæ, and 3 or 4 incomplete auxiliaries, apical denticles 111 to 119, circuli very fine. Four upper canines curved downward; two lower more wide set and greatly divergent. Cheek with 6 rows of scales to preopercle ridge. Color in alcohol dull brown, pale to whitish below. Obsolete pale band from suprascapula backward, usually along lateral line until below soft dorsal when fading out, or sometimes sloping gradually up below front arch of lateral line, crossing latter and continued on back to last dorsal ray bases. From above axilla broad pale band to caudal base medianly, pale sulphury over hind coastal region. Iris pale yellowish. Fins all dull, lower ones ocharceous. Length, 164 to 176 mm. Two from Zamboanga.

As shown in Bleeker's figure, the narrow pale line above the lateral line, extending upward from above the eye, is not evident in our examples.

PENTAPUS NEMURUS (Bleeker).

Head, 3⅔; depth, 3⅖; D. X, 9, I; A. III, 7, I; tubular scales 50 in lateral line to caudal base and 9 nontubular on latter; 3 scales above lateral line to soft dorsal origin, 15 below to spinous anal origin; 36 predorsal scales; snout, 2⅘ in head; eye, 4¼; maxillary, $2\frac{3}{10}$; interorbital, 3. Gill-rakers, 5+5 short tubercles, greatly less than gill-filaments, which 1⅔ in eye. Scales with 9 to 12 basal radiating striae, apical denticles 125 to 150, circuli fine. Five upper canines forward; 2 lower more wide set and divergent. Cheek with 7 rows of scales to preopercle ridge. Color in alcohol dull brown, paler to whitish below. Narrow sulphury line from above eye over suprascapula and lateral line to last dorsal ray base. Broader and brighter sulphury band from each side of snout tip from lower hind half of eye over pectoral axil to caudal base and over median caudal rays. Fins all pale brownish, lower ones whitish. Length, 212 mm. to median caudal ray tips; 314 mm. to end of upper caudal filaments. One from Zamboanga.

Also two younger examples, 108 to 110 mm. from Cebu. Head, 3 to 3⅓; depth, 3¼ to 3⅓; D. X, 9, I; A. III, 7, I; tubular scales 40 to 42 in lateral line to caudal base and 1 more on latter; 2 or 3 scales above lateral line to soft dorsal origin, 3 or 4 above to spinous dorsal origin, 11 or 12 below to spinous anal origin; 31 to 35 predorsal scales; snout, 3 to 3⅓ in head; eye, 3⅓ to 3⅔; maxillary, 2⅞ to 3; interorbital, 3⅓ to 3½. Gill-rakers, 5+4, short low tubercles; gill-filaments, 2⅔ in eye. Scales with 9 to 11 basal radiating striae, apical denticles 90 to 92 and circuli fine. Color in alcohol largely faded dull brown. Pale median band from lower hind eye edge to caudal base medianly, narrow at first and little wider behind. Narrow pale band along back parallel and above lateral line, rather obscure.

PAGRUS SPINIFER Forskål.

Head, 3; depth, 1¾; D. XI, 10, I; A. III, 8, I; tubular scales 50 in lateral line to caudal base and 1 more on latter; 7 scales above lateral line to soft dorsal origin, 18 below to spinous anal origin; 45 predorsal scales forward till over nostrils; snout, 1⅗ in head; eye, 3⅖; maxillary, 3; interorbital, 3⅛. Gill-rakers, 7+10, strong obtuse points, little less than one-third of gill-filaments, which 1½ in eye. Scales with 9 to 11 basal radiating striae, rather obtuse apical denticles 80 to 90 and circuli fine. Dorsal filaments long and slender, reach little beyond caudal base. Pectoral extends back opposite tip of depressed second anal spine. Color in alcohol with back drab, below whitish, everywhere overshot with silvery-white. Fins pale. Length, 210 mm. Takao.

LETHRINUS HARAK (Forskål).

Head, 3; depth, 3; D. X, 9, I; A. III, 8, I; tubular scales 44 in lateral line to caudal base and 4 more on latter; 5 scales above lateral line to soft dorsal origin, 14 below to spinous anal origin; 9 predorsal scales; snout 2 in head; eye 4; maxillary 2⅗; interorbital 3⅗. Gill-rakers, 5+5, obtuse, knob-like, 2 in gill-filaments, which 2⅕ in eye. Scales with 13 to 16 basal radiating striae, and 4 incomplete auxiliaries, 108 to 140 apical denticles, circuli very fine. Color in alcohol dull olive-brown, faded pale below. Each row of scales medianly with slightly darker streak than body color. Just below lateral line, under last dorsal spines dusky-brown obscure blotch, much larger than eye. Soft dorsal and caudal with very faint traces of darker bands, as about three longitudinally on former and four transversely on latter. Length, 280 mm.

Also two smaller, 140 to 146 mm. long. Zamboanga. Head, 2⅘ to 2⅞; depth, 2½ to 2⅔; D. X, 9, I; A. III, 8, I; tubular scales 46 in lateral line to caudal base and 1 or 2 more on latter; 6 rows of scales above lateral line to spinous dorsal origin, 5 above to soft dorsal origin, 14 or 15 below to spinous anal origin; 9 or 10 predorsal scales; head width, 2⅛ to 2⅕ in its length; snout, 2⅛ to 2⅕; eye, 3⅗ to 3⅔; maxillary, 2⅔ to 2¾; interorbital, 4⅛ to 4¼; pectoral, 1⅒ to 1⅕. Snout conic, width 1⅓ to 1½ in its length. Jaws about even or lower very slightly included. Maxillary opposite hind nostril. Teeth conic, even hind ones, which hardly molar. Gill-rakers, 5 or 6+5 or 6, half of gill-filaments, which 2⅓ in eye. Scales small and crowded along anal base, smaller on breast than on predorsal. Basal radiating striae 14 or 15, apical denticles 80 to 88, circuli fine. Dorsals and anals low. Second and third anal spines about equal.

Color in alcohol dull olive brown above, paler to whitish beneath. Each scale with paler center or spot, obsolete, yet suggesting lengthwise streaks. Opposite outer half of depressed pectoral and slightly beyond borders or bases of scales darker or more deeply brownish so as to form an ill-defined large dark blotch below lateral line, though much greater than eye in extent. Cheek tinged with natal-brown. Iris very pale yellowish. Under surface of head whitish. Dorsals grayish, with pale dusky-gray shading marginally on spinous fin, and soft fin with three dark gray longitudinal bands. Caudal with four transverse bands. Outer portions of ventrals dusky-gray. Brownish spot in pectoral axil.

We believe these two young examples to represent an adolescent stage, but have not yet found the obscure dark bands on the soft dorsal and caudal noticed previously. In some respects they are suggestive of *L. carinatus* Weber,[27] a much deeper species. *L. bonhamensis* Gunther[28] appears to be synonymous. *L. atkinsoni* Seale[29] may antedate *L. carinatus* Weber. It is not described with markings on the soft dorsal and caudal, though its ventrals are said to be dusky on their posterior third.

Family GERRIDAE.

GERRES KAPAS Bleeker.

Head, 3 to 3⅛; depth, 2½ to 2¾; D. IX, 10, I; A. III, 7, I; scales about 38? in lateral line to caudal base (squamation damaged); 4 scales above lateral line to spinous dorsal origin, 8? below to spinous anal origin; 14 predorsal scales to frontal fontanelle; snout, 3 to 3⅓ in head; eye, 3 to 3⅛; maxillary, 2½ to 2⅔; interorbital, 2⅘ to 2⅞. Gill-rakers, III, 1+8, lanceolate, about 2 in filaments or 4 in eye. Scales with 6 to 10 basal radiating striae, fine circuli very largely parallel and vertical. Premaxillary groove broadly naked. Color in alcohol largely pale brown on back. Sides and below bright silvery-white. Fins pale brown. Brown spot on membranes of last half of spinous dorsal and on all of soft dorsal. Length, 133 to 138 mm. Three from Zamboanga.

Three young examples in the Academy from the Philippines agree, except in such differences as are due to age, like larger eye, etc.

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[27] *Siboga* Exped., Fish., vol. 65, 1913, p. 289, pl. 2, fig. 1. Seget, Western New Guinea; Tual, Medrig Kei.

[28] Journ. Mus. Godeffroy, vol. 2 (1) 1873–1875, p. 65, pl. 47. Bonham Island.

[29] Philippine Journ. Sci., vol. 4 (6) 1909, p. 515, pl. 11. Balabac Island.

GERRES FILAMENTOSUS Cuvier.

Head, 3; depth, 2½; D. IX, 10, i; A. III, 7, i; scales, 40 in lateral line to caudal base and 3 more on latter; 6 scales above lateral line to spinous dorsal origin, 9 below to spinous anal origin; 13 predorsal scales to frontal fontanelle; snout, 3⅕ in head; eye, 3⅗; maxillary, 2¾; interorbital, 3. Gill-rakers, vi+7, lanceolate, 3 in gill-filaments, which 2⅜ in eye. Scales with 6 to 10 basal radiating striae, circuli extremely fine. Second dorsal spine filamentous, extends back opposite base of last soft ray. Color in alcohol with back pale brownish, with about ten to twelve pale dusky vertical lines. Sides, lower surface and iris bright silvery-white. Spinous dorsal blackish on membranes terminally. Row of dark spots, one on each membrane below middle. Edge of snout dusky. Length, 114 mm. Takao.

Two examples in the Academy from Sumatra compared, which do not show the dark vertical streaks, doubtless a condition of preservation.

PENTAPRION LONGIMANUS (Cantor).

Head, 3½; depth, 2⅗; D. IX, 15; A. V, 13; scales mostly fallen; snout, 3¼ in head; eye, 2⅞; maxillary, 2½; interorbital, 2⅔. Gill-rakers, 5+13, lanceolate, four-fifths of gill-filaments or 4 in orbit. Scales with 1 to 3 basal radiating striae, circuli fine, and apical circuli extremely fine and numerous. Color in alcohol with scales largely bright silvery-white. Median bright silvery vertebral streak laterally. Iris silvery-white. Fine pale, membranes of spinous dorsal grayish terminally. Length, 127 mm. Takao.

Family MULLIDAE.

UPENEOIDES BELAQUE Fowler.

Head, 3⅓; depth, 3⅗; D. VIII—I, 8, i; A. I, 6, i; scales 32 in lateral line to caudal base and 2 more on latter; 3 scales above lateral line to soft dorsal origin; 7 below to spinous anal origin; 16 (pockets) predorsal scales; snout, 2⅘ in head; eye, 4; maxillary, 2⅘; interorbital, 3¼. Bands of fine teeth in jaws, on vomer and palatines. Gill-rakers, 9+19, lanceolate, 1¼ in gill-filaments, which 1⅓ in eye. Scales with 5 or 6 basal radiating striae, apical denticles 60 to 62 and circuli very fine. Color in alcohol faded dull brownish generally. Spinous dorsal pale or whitish, with two horizontal dark brown bands and broad jet black apical blotch. Soft dorsal similar, only basal and lower bands appear slightly oblique across fin, owing to its inclination, and apical leaves fin tip pale. Upper caudal lobe with four oblique dark bands, about wide as interspaces and lower lobe with but three oblique bands. Length, 108 mm. Zamboanga.

Compared with the types in the Academy and found in agreement. The types, owing to preservation, do not now show any traces of dark caudal bars, and we think it quite likely they were obliterated by the strong preserving fluid. There is also variation in the dark bands on the dorsals, some of which are the exact pattern of the Zamboanga specimen.

UPENEOIDES BENSASI (Schlegel).

Head, 3⅖; depth, 4⅗ to 4¾; D. VII, once V—I, 8, I; A. I, 6, I; scales, 28 or 29 in lateral line to caudal base and 2 or 3 more on latter; 2 scales above lateral line to soft dorsal origin, 2 above to spinous dorsal origin, 7 below to spinous anal origin; 6 predorsal scales; snout, 2½ to 2¾ in head; eye, 3⅓ to 3⅞; maxillary, 2⅖; interorbital, 3¼ to 3¾. Gill-rakers, III, 5+12, IV, lanceolate, about as long as gill-filaments or 2 in eye. Scales with 4 to 6 basal radiating striae, apical denticles 70 to 75 and circuli very fine. Color in alcohol brown, paler to whitish below. All specimens show muzzle and edges of preopercle more or less blotched with reddish-brown. Iris silvery-white. Dorsals marked much as in *U. belaque*, each with three horizontal dark bands. Each caudal lobe with four oblique dark bands, terminal jet black. Length, 68 to 102 mm. Twenty-one examples from Takao.

UPENEOIDES TRAGULA (Richardson).

Head, 3⅕ to 3⅖; depth, 4 to 4⅕; D. VIII—I, 7, I; A. I, 6, I; scales, 30 in lateral line to caudal base and 2 more on latter; 3 scales above lateral line to soft dorsal origin, 6 below to spinous anal origin; 4 predorsal scales; snout, 2⅕ to 2½ in head; eye, 4½ to 4¾; maxillary, 2⅓ to 2½; interorbital, 3⅓ to 3⅖. Gill-rakers III or IV, 1 to 3+11 or 12, *v* or VI, lanceolate, 1 to 1⅔ in gill-filaments, which 1⅓ to 1⅞ in eye. Scales with 5 or 6 basal radiating striae, apical denticles 138 to 153 and circuli very fine. Color in alcohol with back dull brown, sides and below whitish, everywhere more or less variably speckled with darker spots. Dark brown band from snout tip through eye and back along side to middle of upper caudal lobe basally. Spinous dorsal dusky apically, with six dark transverse bands, upper black. Soft dorsal similar, only with less black and most transverse bands paler. Caudal barred like dorsal, upper lobe with five and lower with seven transverse black bands. Other fins much paler, also cross bars, of which six on pectoral and five on ventral and anal. Length, 128 to 233 mm. One from Cebu and Zamboanga, respectively.

The Cebu specimen, although in poor preservation, agrees better with Day's figure. It has the outer caudal and soft dorsal bars similarly broader.

UPENEUS BARBERINUS (Lacépède).

Head, 3; depth, 3⅓ to 3⅖; D. VIII—I, 8, I; A. I, 6, I; scales, 28 in lateral line to caudal base and 3 more on latter; 2 or 3 scales above lateral line to soft torsal origin, 6 below to spinous anal origin; 13 predorsal scales; snout, 1¾ to 1⅘ in head; eye, 5 to 5⅓; maxillary, 3⅙ to 3½; interorbital, 4 to 4¼. Gill-rakers, 6+21, lanceolate, 1½ in gill-filaments, which 1⅕ in eye. Scales with 5 basal radiating striae, apical denticles 140 to 142 and circuli fine. Color in alcohol pale brown, sides and below, whitish. Dorsal darker apically, fins otherwise mostly pale. Deep brown band from each side of snout tip to eye, then back to suprascapula and along lateral line till opposite soft dorsal, when continued upward to upper surface of caudal peduncle. Round, deep brown spot, size of eye, in lateral line at caudal base. Length, 163 to 173 mm. Two from Zamboanga.

UPENEUS MULTIFASCIATUS (Quoy and Gaimard).

Head, 3⅛ to 3⅕; depth, 3⅓; D. VIII—I, 8, I; A. II, 6, I; scales, 27 in lateral line to caudal base and 3 more on latter; 2 scales above lateral line to soft dorsal origin, 3 above to spinous dorsal origin, 7 below to spinous anal origin; 14 predorsal scales; snout, 1⅘ to 1⅝ in head; eye, 5 to 5⅔; maxillary, 2⅗ to 2¾; interorbital, 3⅗ to 3¾. Gill-rakers, 7+28, lanceolate, about as long as filaments or 1⅔ in eye. Scales with 7 radiating basal striae, apical denticles 139 to 141 and circuli very fine. Color in alcohol, pale brown above, still paler to whitish below. Deep brown blotch close behind eye, about its equal. Another, much larger, at front two-thirds of soft dorsal base and finally one saddle like on upper surface of caudal peduncle. Pale vertical streak at soft dorsal origin and interspace between soft dorsal and caudal dark blotches, pale-like belly. Spinous dorsal grayish. Soft dorsal blackish medianly and basally, including all of last ray. Upper half of soft dorsal with two closely set submarginal parallel lines. Anal pale, with four or five longitudinal brownish lines. Other fins all pale. Ventrals margined externally with brownish, also upper and lower edges of caudal lobes narrowly brownish. Length, 168 to 190 mm. Two from Zamboanga.

MULLOIDES AURIFLAMMA (Forskål).

Head, 3⅓ to 3½; depth, 3⅞ to 4⅕; D. VII—I, 8, I; A. II, 6, I; scales, 35 in lateral line to caudal base and 2 more in latter; 3 scales above lateral line to soft dorsal origin, 3 above to spinous dorsal origin, 6 below to spinous anal origin; 14 predorsal scales; snout, 2⅕ in head; eye, 4; maxiallary, 3⅗ to 3⅔; interorbital, 3½ to 3¾. Gill-rakers, 7+18, lanceolate, 2 in gill-filaments, which 1½ in eye. Scales with 6 or 7 basal radiating striae, apical denticles 105 and circuli very fine. Color in alcohol pale olive above, sides and below lighter to whitish.

with slight yellowish tint. Dorsals and caudal little darker than other fins. Length, 163 to 170 mm. Two from Zamboanga.

Family POLYNEMIDAE.

POLYDACTYLUS TETRADACTYLUS (Shaw).

Head, 3½; depth, 4¼; D. VIII—I, 14, I; A. III, 15, I; scales, 90 in lateral line to caudal base and about 35 more out on caudal along upper portion of lower lobe to hind edge of fin; 16 scales above lateral line to soft dorsal origin, 20 below to spinous anal origin; about 56 predorsal scales; snout, 6⅞ in head; eye, 4⅞; maxillary, 1⅝; interorbital, 4⅓. Gill-rakers, 6+7, lanceolate, about one-fourth longer than gill-filaments or 1⅞ in eye. Scales with 1 to 3 basal radiating striae, apical denticles 40 to 55 and circuli moderate. Pectoral filaments 4, reach about five-sixths in fin. Color in alcohol olive-brown above, paler to whitish below, with silvery reflections. Fins brownish. Pectoral and anal dark apically. Ventral pale, also pectoral filaments. Length, 303 mm. Takao.

POLYDACTYLUS INDICUS (Shaw).

Head, 3½; depth, 3⅓; D. VIII—I, 13, I; A. III, 12, I; scales, 70 in lateral line to caudal base, where forking and sending off two branches, one along each inner portion of emargination of caudal to its edge; 9 scales above lateral line to spinous dorsal origin, 9 above to soft dorsal origin, 11 below to spinous anal origin; 35 predorsal scales; snout, 5 in head; eye, 4⅓; maxillary, 2; interorbital, 3¾. Gill-rakers, 13+17, lanceolate, little over twice gill-filaments or 1⅓ in eye. Scales with 5 to 7 radiating basal striae, apical denticles 43 to 48 and circuli moderate. Pectoral filaments 5, some reach anal origin. Suprascapular spine distinct and slightly larger one at preopercle angle. Color in alcohol with back nearly olive-brown, sides and below pale to whitish. Fins dark like back, except outer apical whitish borders of ventral. Length, 182 mm. Takao.

Family POMACENTRIDAE.

POMACENTRUS PROSOPOTAENIA Bleeker.

Head, 2⅗ to 3; depth, 2 to 2⅓; D. XII, 15 I; A. II, 13, I; tubular scales 16 or 17 in upper arch of lateral line, 7 pores in hind section to caudal base; 3 scales above lateral line to spinous dorsal origin, 10 below to spinous anal origin; 20 or 21 predorsal scales; snout, 2½ in head; eye, 4⅖ to 4⅘; maxillary, 3⅖; interorbital, 3⅛ to 3⅓. Teeth uniserial, truncate. Gill-rakers, 13+17, weakly lanceolate, 3 in gill-filaments, which equal eye. Scales with 8 or 9 basal radiating striae, apical denticles 146 to 215 and circuli very fine. Color in alcohol blackish-brown above, becoming nearly bay on breast and belly.

Head with a number of small gray spots around eye, on cheeks and opercles. Obscure or obsolete small spots above anal and behind pectoral. Fins all more or less dusky, only pectoral paler. Axilla pale. Traces of pale line, linking nostrils across snout. Length, 147 to 165 mm. Two from Zamboanga.

POMACENTRUS FORMOSANUS, new species.

Head, 3⅓; depth, 2⅗; D. X, 12, i; A. II, 12, i; P. iii, 17; V. I, 5; tubular scales 29 in upper arch of lateral line and 15 pores in horizontal section, of which last one on caudal base; 47 scales between suprascapula and caudal base; 7 scales above lateral line to spinous dorsal origin, 13 below to spinous anal origin; 18 predorsal scales; head width, 1¾ in its length; head depth about equals its length; snout, 4⅓; eye, 3; maxillary, 2½; interorbital, 3; first dorsal spine, 3¾; tenth, 2; fourth dorsal ray, 1¾; second anal spine, 2⅕; fifth anal ray, 2; least depth of caudal peduncle, 2⅕; caudal, 1; pectoral, 1⅛; ventral, 1⅓.

Body elongately ellipsoid, deepest about midway in its length, well compressed and edges convexly rounded. Caudal peduncle well compressed and least depth about equals its length.

Head moderate, rather robust, well compressed, flattened sides very slightly converging below, profiles alike. Snout convex over surface and in profile, length three-fifths its width. Eye large, circular, little elevated and hind pupil edge nearly midway in head length. Mouth moderately wide, gape short, oblique, closed jaws about even. Lips fleshy, rather narrow. Maxillary large, well inclined and exposed, reaches well beyond front eye edge, only narrow upper edge slipping below little differentiated preorbital. Teeth moderately small, uniserial, somewhat compressed, pointed and not forming cutting edge, also slightly larger in front of jaws. Greater portion of maxillary edge with finer similar teeth. No teeth on mouth roof or tongue. Inner buccal folds moderately wide. Tongue depressed, moderate, free. Nostril small pore little behind middle in eye. Pseudobranchiae slightly less than gill-filaments. Branchinarrow, width little less than that of maxillary. Hind preopercle edge roughly serrate. Opercle with two spines, lower little more backward.

Gill-opening extends forward about opposite front eye edge. Gill-rakers, 8+19, lanceolate, slightly shorter than gill-filaments or 2¼ in eye. Pseudobranchiae slightly less than gill-filaments. Branchiostegal membrane short, forms very short fold across narrow constricted isthmus.

Scales finely ctenoid, become little smaller about body edges and in lengthwise rows parallel with lateral line. All larger scales rather narrowly imbricated. Soft dorsal, anal, caudal and pectoral bases with small scales. Scale between ventral bases nearly half length of fin. Axillary ventral scale about two-fifths of fin. Cheek with 4 rows of scales, completely covering infraorbitals. Snout, including front of interorbital, maxillary, lips, and mandible naked. Scales with 5 to 9 basal radiating striae, apical denticles 38 to 52, and circuli fine. Upper section of lateral line formed of rather broad tubes, mostly with small bifurcations extended backward behind middle in dorsal base. Pores of straight hind section small, inconspicuous, simple.

Spinous dorsal origin slightly before that of pectoral, anterior median spines highest, fin edge slightly notched and cutaneous pointed flap behind tip of each spine. Soft dorsal inserted near last third in space between front pupil edge and caudal base, fin slightly rounded or with median rays little longest. Spinous anal inserted little nearer pectoral origin than caudal base, first spine three-fifths of second. Caudal deeply emarginate, lobes pointed, upper longer and ends in cutaneous point. Pectoral broad, fin rounded. Ventral inserted nearly opposite first fourth in depressed pectoral, well behind base of latter, reaches vent, spine two-thirds length of fin. Vent close before anal.

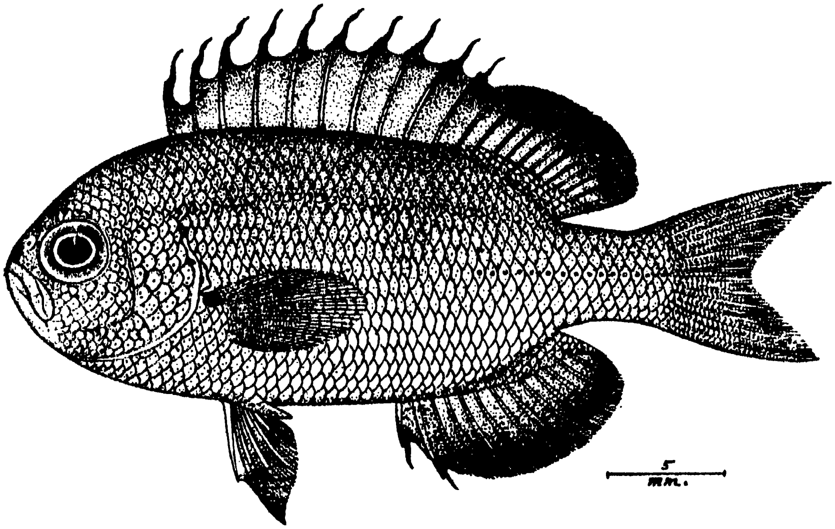

FIG. 4.—POMACENTRUS FORMOSANUS, NEW SPECIES.

Color in alcohol nearly mars-brown, sides paler or almost dull saccardo-umber, and lower surface with tinges nearly cinnamon-buff and tawny, latter especially along belly. Dorsals and anals dusky on outer portions. Pectoral and caudal dull or pale brown, likewise ventral, except latter with tips of soft rays tinged dusky. Conspicuous black blotch, little smaller than pupil, at origin of pectoral fin and adjoining forward pale or whitish area of nearly equal extent. Iris dull bluff-yellow.

Length, 70 mm.

Type.—Cat. No. 76644, U.S.N.M. Takao, Formosa. Dr. Fred Baker.

Only the type known. In some respects the species superficially resembles *Pomacentrus jerdoni* Day, of which we have compared a Philippine example in the Academy. This is largely in general coloration of the preserved examples and the black blotch at the pectoral origin. The structural characters of distinction for *P. formosanus* are the shorter body and greatly smaller scales.

(Named for Formosa.)

ABUDEFDUF COELESTINUS (Cuvier).

One 142 mm. long. Cebu. Compared with Samoan and Philippine material in the Academy.

ABUDEFDUF CURACAO (Bloch).

Head, 3⅛; depth, 1½; D. XIII, 12, I; A. II, 13, I; tubular scales 18 in upper arch of lateral line and 8 pores in horizontal hind section to caudal base; 3 scales above lateral line to spinous dorsal origin, 10 below to spinous anal origin; 27 predorsal scales; snout, 3⅘ in head; eye, 3; maxillary, 2¾; interorbital, 2½. Teeth uniserial, truncate incisors. Suborbital and preorbital edges entire. Gill-rakers, 8+20, 1¼ in gill-filmaments or 2 in eye. Scales with 9 or 10 marginal striae and often 2 to 10 irregular or incomplete auxiliaries, apical denticles 120 to 170, circuli very fine. Color in alcohol olivaceous on back, paler to whitish below. Four broad transverse or vertical bands of olivaceous-dusky; first at predorsal and front of spinous dorsal to pectoral base and postventral region; second from middle of spinous dorsal to spinous anal; third from last dorsal spines; fourth on caudal peduncle. Spinous dorsal dusky, fins otherwise pale. Pectoral and ventral pale yellowish. Length, 110 mm. Zamboanga.

Our example differs a little from Bleeker's colored figure of *Glyphidodon trifasciatus* in that its bands are less sharply defined. He shows two dark bands from the front of the spinous dorsal, whereas in our example they largely appear as one. The species is variable. Three Philippine examples in the Academy, though structurally in agreement, show the first and second dark transverse bands quite diverse.

ABUDEFDUF LEUCOGASTER (Bleeker).

Head, 3⅖; depth, 1⅘; D. XIII, 11, I; A. II, 12; tubular scales 17 in upper arch of lateral line and 8 pores in horizontal hind section to caudal base; 8 scales above lateral line to spinous dorsal origin, 9 below to spinous anal origin; 22 predorsal scales; snout, 3 in head; eye, 3; maxillary, 3; interorbital, 2⅜. Teeth uniserial, with slight notch on median margin so as to form bilobate pattern. Gill-rakers 7+15, lanceolate, seven-eighths of gill-filaments or 3 in eye. Scales with 3 to 7 radiating marginal striae, apical denticles 34 to 137 and circuli very fine. Caudal well emarginated. Color in alcohol faded largely dull brownish, sides with brassy tinge below. Small obscure irregular gray spots on sides and about head. Vertical fins gray-brown. Paired fins dull brown. Iris pale greenish-yellow. Length, 96 mm. Zamboanga.

Compared with an example in the Academy from Sumatra and agrees.

ABUDEFDUF MELANOPSELION Fowler.

Head, 3; depth, 1⅞; D. XIII, 13, I; A. II, 14; tubular scales 16? in upper arch of lateral line and 6 pores in horizontal hind section to caudal base; 5 scales above lateral line to spinous dorsal origin, 9 below to spinous anal origin; 22 predorsal scales; snout, 2⅞ in head; eye, 3⅘; maxillary, 3⅜; interorbital, 2¾. Teeth uniserial truncate incisors. Gill-rakers, about 33+35, finely lanceolate, one-fifth longer than gill-filaments or seven-eighths of eye. Scales with 8 to 11 basal radiating striae, apical denticles 110 to 185 and circuli very fine. Color in alcohol with back prout's-brown, fading paler or somewhat tawny-olive on side and lower region. Dorsals, anals, and ventrals dusky, at least terminally or on outer portions. Black spot at bases of last two dorsal rays, little less than pupil in size. Pectoral and caudal pale brown. Iris slaty. Length, 94 mm. Cebu.

Compared with the type in the Academy and found only to vary in color. Traces of the dark blotch at pectoral base evident in Cebu example, though much more faded on right side. The type is much more contrasted, as shown in the original figure. This does not show the black blotch at bases of last dorsal rays, though it is still evident on the specimen, but more distinct on the right than on the left side.

DASCYLLUS ARUANUS (Linnaeus).

Seven from Zamboanga. Length, 35 to 67 mm.

Family LABRIDAE.

HEMIPTERONOTUS SPILONOTUS (Bleeker).

Head, 3 to 3⅕; depth, 2½ to 2⅘; D. II, VII, 12, I or 13, I; A. III, 12; scales 20 in upper section of lateral line, 5 in lower hind section to caudal base and 1 more on latter; 2 scales above lateral line to third dorsal spine base, 9 below to spinous anal origin; snout, 1¾ to 2 in head; eye, 4¾ to 5⅘; maxillary, 3⅗ to 3½; interorbital, 6⅛ to 7. Gill-rakers, 6+15, conic, firmly lanceolate, about two-thirds of gill-filaments, which 1⅗ in eye. Scales with 61 to 65 basal radiating striae, and about 3 to 7 short auxiliary marginals, 60 to 68 apical radiating weak striae and circuli moderately fine. Color in alcohol, large example generally same as *H. pentadactylus*. Pale blue-gray line along median keel of snout front. Mandible with four blue-gray vertical lines each side. Lateral line with eighth scale jet black. Humeral scale with blue-gray line, also cluster of several scales about end of depressed pectoral with blue-gray bases, line of demarcation from rest of scale showing them sharply vertical. Gray line across pectoral base. Iris buff-yellow. Soft dorsal and anal grayish, with oblique whitish lines, more or less broken into small spots toward deeper terminal part of soft dorsal. Caudal grayish, with seven or eight vertical pale or whitish cross bands. Pectoral brownish above and terminally, otherwise pale like ventrals. Two examples, 115 to 152 mm. Takao.

Smaller example without blue-gray lines on head very distinct and black of eighth scales of lateral line extended upon base of one above. It certainly approaches *H. evides* Jordan and Richardson[30], which we think a synonym. There are no characters shown in the description or figure of *H. evides* to ever have allowed it distinct from *H. spilonotus*. Further, no discussion of its status, in comparison with other species, has ever been advanced.

HEMIPTERONOTUS PENTADACTYLUS (Linnaeus).

Head, 3⅛; depth, 2⅘; D. II, VII, 12, I; A. III, 12, I; scales 20 in upper section of lateral line, 4 in lower hind section to caudal base and 1 more on latter; 3 scales above lateral line to third dorsal spine base, 10 below to spinous anal origin; snout, 2⅒ in head; eye, 5⅛; maxillary, 3⅓; interorbital, 5⅗. Gill-rakers, 6+12, conic, firmly lanceolate, about three-fourths of gill-filaments and latter 1⅗ in eye. Scales with 56 or 57 basal radiating striae, and 2 to 5 auxiliary short ones, about 44 to 60 apical radiating weak striae, and circuli moderately fine. Color in alcohol faded pale brown, but slightly paler below. Pale blue-gray line from snout tip to dorsal along frontal keel. Front mandible edge and median cutaneous fold of branchiostegal region likewise. Each side of mandible with two blue-gray narrow lines, first little before middle and second little backward. Iris pale buff-yellow. Pale yellowish scale at suprascapula sprinkled slightly with blackish. Lateral line with second to fifth scales more or less pale yellowish, but second to fourth more blackish than suprascapular. Blotch of dull brown extends about over four scales, one scale below lateral line and just before pectoral end. Dorsals grayish, spotted and blotched with white. Anals grayish, with about three whitish longitudinal narrow bands, more or less complete. Caudal little more dusky, upper and lower edges especially deeper but narrowly so, and fin with about five vertical pale or whitish narrow cross bands. Other fins pale. Pectoral slightly pale dusky terminally. Length, 145 mm. Takao.

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[30] Mem. Carnegie Mus., vol. 4, No. 4, 1909, p. 196, pl. 72.

Also three smaller examples, same data, but without the dark scales at the beginning of lateral line. In the largest they show only a small whitish spot apically on scale. In the smaller example no blue-gray lines on head. Head, 3¼; depth, 3⅛; D. II, VII, 12, I; A. III, 12, I; scales 21 in upper section of lateral line, 5 in lower hind section to caudal base and 1 more on latter; 3 scales above lateral line, 9 below; snout, 2⅛ to 2⅞; eye, 4 to 5¼; maxillary, 3⅝ to 3½; interorbital, 5⅔ to 6; length, 75 to 136 mm.

Snyder has described *H. jenkinsi* from a young Hawaiian specimen, an inch long, which is shown without scales on the cheek and black blotch above the lateral line below front of soft dorsal. From this it appears to us it is probably an *Iniistius*, likely the young of *I. aneitensis* (Gunther).

EPIBULUS INSIDIATOR (Pallas).

Two examples, 162 to 222 mm. Zamboanga. Neither of these specimens show the pectoral fin as contrasted, or pale, as in Bleeker's figure.

CHEILINUS FASCIATUS (Bloch).

Length, 325 mm. Zamboanga. About the suprascapular region, postpectoral and humeral also, each scale marked with a decided and contrasted blackish-brown blotch basally.

CHEILINUS TRILOBATUS Lacépède.

Length, 307 mm. Cebu. Agrees with Gunther's figure[31] of a Samoan example. Our specimen shows both soft dorsal, anal, and caudal, with their elongated points more pronounced. In alcohol its breast and belly are spotted paler, and along the median line assume quite large pale blotches. Similar ones also occur on the lower surface of the head.

Family CALLYODONTIDAE.

CALLYODON BALINENSIS (Bleeker).

Head, 2⅞; depth, 2¾; D. IX, 10, I; A. III, 8, I; scales, 18 in upper section of lateral line, 5 in lower section to caudal base and 2 more on latter; 2 scales above lateral line to spinous dorsal origin, 6 below to spinous anal origin; 5 predorsal scales; 3 rows of cheek scales; snout, 2⅜ in head; eye, 5¾; maxillary, 5; interorbital, 3. Single exposed posterior canine above each side. Gill-rakers, 11+24, slender fine flexible points, 4½ in gill-filaments, which equal eye. Scales with 30 basal radiating striae, apical striae 28, parallel. Dorsal spines flexible. Caudal concave behind. Color in alcohol, back nearly sepia, below paler to nearly maize-yellow. Dorsals, anals, and caudal, also upper pectoral edge, brown like back, though outer portions of all darker. Obscure transverse band of brown across interorbital connecting eyes. Length, 190 mm. Zamboanga.

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[31] Journ. Mus. Godeffroy, vol. 15 (VII), 1881, pl. 131.

CALLYODON PRONUS (Fowler).

Head, 2⅘; depth, 2¾; D. IX, 10, I; A. III, 9, I; scales 18 in upper section of the lateral line, 5 in lower section to caudal base, and 2 more in latter; 2 scales above lateral line to spinous dorsal origin, 6 below to spinous anal origin; 4 predorsal scales; snout, 2⅔ in head; eye, 6⅗; maxillary, 6⅛; interorbital, 3. Two posterior canines each side above and one below each side. Gill-rakers, 12?+31, slender, flexible, 4 in gill-filaments, which equal eye. Scales with 36 basal radiating striae, apical striae 32. Color in alcohol now largely faded dull uniform brown. Lips pale. Pale line from rictus to lower edge of eye. Small blackish blotch, less than pupil in size, at pectoral origin. Dorsals and anals with submarginal dusky line, leaves fin edges pale yellow, though that of anals broader. Emarginated caudal also with similar dark line behind. Length, 203 mm. Cebu.

Compared with the type of *Scarus pronus* Fowler[32] in the Academy and agrees. Slight differences, due to preservation and individual variation evident. In type two lower left canines, though only one right. While our Cebu example shows but two rows of cheek scales type has three, the lowest on the preopercular flange. We think in the case of the Cebu example they may have fallen. The front profile is less sinuous. Though the type has been varnished, the black spot at the pectoral origin is still apparent.

CALLYODON MURICATUS (Valenciennes).

Head, 2⅘ to 3; depth, 2⅗ to 2⅘; D. IX, 9, I, or 10, I, A. III, 9, I; scales, 16 or 17 in upper section of lateral line, 8 or 9 in lower section to caudal base and 2 more on latter; 2 scales above lateral line to spinous dorsal origin, 7 below to spinous anal origin; 5 predorsal scales; snout, 2 to 2⅙ in head; eye, 5 to 6⅓; maxillary, 4 to 4¼; interorbital, 3 to 3⅖. No posterior canines. Upper lip covers at least half of teeth. Gill-rakers, 7+9 short weak flexible points, 5 in filaments, latter equal eye. Three rows of cheek scales. Scales with 37 basal radiating striae, apical striae 14. Caudal rounded convexly. Color in alcohol with back deep benzo-brown to fuscous, becoming paler to dark ecru below. Dorsals, anals, caudal, and ventral blackish, more or less pale or slaty basally. Pectoral paler. Iris pale yellowish-white. Lips dusky. Teeth pale or whitish. Side of body with seven vertical series of nearly light cinnamon-drab spots, on trunk three of four spots in each series, though on caudal peduncle only one or two. All spots with slightly darker marginal edge. Length, 185 to 255 mm. Two from Zamboanga.

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[32] Proc. Acad. Nat. Sci. Phila., 1899, p. 490, pl. 18, fig. 3. Thornton Island.

Seale describes *Callyodon albipunctatus* from Sitanki Island, Jolo Archipelago, based on an example but 170 mm. long. Its coloration suggests the present species, though it is said to have only two rows of scales on the cheek and the lower limb of the preopercle naked. Also the gill-rakers are said to be numerous, minute, and hairlike.

PSEUDOSCARUS NUCHIPUNCTATUS (Valenciennes).

Head, 3; depth, 2⅗; D. IX, 9, I; A. III, 9, I; scales 17 in upper section of lateral line, 3 in lower section to caudal base and 2 more on latter; 2 scales above lateral line to spinous dorsal origin, 6 below to spinous anal origin; 7 predorsal scales; snout, 2⅓ in head; eye, 7¼; maxillary, 4¼; interorbital, 2¾. Two posterior upper cannies, hind one smaller and hidden. Gill-rakers about 15+45, finely lanceolate, flexible, 3½ in gill-filaments, which nearly equal 1½ eye diameters. Three rows of scales on cheeks. Scales with 31 basal radiating striae, apical radiating striae 40. Color in alcohol deep seal-brown generally, more or less uniform over trunk. Teeth greenish. Upper lip pale to whitish, with submarginal yellowish-citrine parallel cross band. Lower jaw with two similar pale bands, followed by two streaks of same color over subopercle region. Edge of lower lip narrowly grayish, separated from yellow-citrine band by seal-brown line. Streak of yellowish-citrine across preorbital to rictus, and small blotches or spots of same color over rest of suborbitals. Several small yellowish-citrine spots above opercle and larger buff blotch in first scale of lateral line. Fins dark like general body color, margins of all except pectorals distinctly pale or buffy and on dorsals and anals separated from dark basal color by narrow dusky line. No basal pale bands, as shown in Bleeker's figure, though last ray of each fin with tinge of yellowish-citrine basally and externally. The black spots shown on the body scales of Bleecker's figure are not evident. Length, 273 mm. Zamboanga.

We agree with Gunther in admitting *P. prasiognathus* Jordan and Seale and *P. maoricus* Jordan and Seale, to the synonymy of this species.

PSEUDOSCARUS FORSTERI (Valenciennes).

Head, 2⅗ to 2⅔; depth, 2½ to 2¾; D. IX, 10, I; A. III, 9, I; scales 17 in upper section of lateral line, 5 or 6 in lower section to caudal base and 2 more on latter; 2 scales above lateral line to spinous dorsal origin, 6 below to spinous anal origin; 4 predorsal scales; snout, 2⅕ to 2¼ in head from tip of upper tooth; eye, 6¾ to 7; maxillary, 3⅘ to 4; interorbital, 3 to 3⅛. Two rows of scales on cheek. Last or most posterior denticle of cutting edge of upper teeth, little enlarged. Gill-rakers, 20+35?, finely lanceolate, flexible, about one-fourth of gill-filaments, which 1¼ eye diameters. Scales with 38 basal radiating striae, apical striae nearly parallel, about 38. Color in alcohol more or less yellowish, back tinged brown. Citrine-yellow band across each lip with edge narrowly whitish, colors on upper lip separated by brownish line and behind rictus unite, then extend up to lower eye edge and back across preopercle. Above last deep brown band of equal width, though most conspicuous close to eye. Still above, from hind eye edge, two more citrine-yellow short bands radiate backward, each in turn separated by brownish. Dorsals with submarginal brownish or yellowish band, separated below by darker brownish line. Anal with outer three-fifths citrine, remaining basal portion whitish. Caudal pale; hind concave edge (folded) pale brown (when expanded convex). Pectoral pale brown, edge narrowly pale citrine followed with grayish band, and below that yellowish band. Ventral pale brownish. Jaws pale bluish. Interorbital pale forward. Length, 206 to 232 mm. Zamboanga.

In the presence of only two rows of scales on the cheek our examples agree with the figures of *Pseudoscarus capistratoides* Bleeker[33] and Gunther's figure of a Tahitian example. Though no projecting canines are developed, there is apparently an obsolete one above each side, scarcely protruded and covered largely by the upper lip. Possibly with age they may become erect and project.

Family ILARCHIIDAE.

HARPOCHIRUS LONGIMANUS (Schneider).

Head, 2⅘ to 3; depth, 1⅙ to 1¼; D. I, VIII, 20, I; A. III, 16, I, 17, I; scales, 75 or 76 close above and along lateral line to caudal base; tubular scales 45 to 49 in lateral line to caudal base; 18 or 19 scales above lateral line to second dorsal spine base, 37 to 42 scales below to spinous anal origin; snout, 2⅙ to 2⅕ in head; eye, 3⅗ to 3½;

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[33] Atlas Ichth., vol. 1, 1863, pl. (1) 6, fig. 2.

maxillary, 3¼ to 3⅓; interorbital, 3⅓ to 3⅘. Gill-rakers, 5+9, short conic points, 3 in gill-filaments, which 1¾ in eye. Scales with 2 or 3 basal radiating striae, circuli fine, crescentic. Pectoral reaches at least to straight section of lateral line on caudal peduncle. Color in alcohol largely silvery. Back with light, obscure, slightly darker brown vertical bands, alternately wide and narrow. Two examples, 178 to 193 mm. Takao.

Family PLATACIDAE.

PLATAX TEIRA (Forskål).

Head, 2⅘ to 3; length, 1⅕ in depth; D. V, 35 or 36; A. III, 26; scales about 70 counted close along and above lateral line to caudal base; tubular scales 48 to 51 in lateral line to caudal base; scales 53 to 55 from gill-opening to caudal base; 30 scales above lateral line to soft dorsal origin, 47 to 49 below to spinous anal origin; snout, 2¾ to 2⅞ in head; eye, 2⅘ to 3; maxillary, 3⅓ to 3⅗; interorbital, 2⅔ to 2¾. Gill-rakers, 9+9, firmly lanceolate ceratobranchial 4 in gill-filaments, epibranchial uniformly obtuse. Scales with 4 or 5 basal radiating striae, also 1 to 3 auxiliary short marginals, apical 21 to 24 short denticles and circuli moderately fine. Color in alcohol nearly light quaker-drab, more or less uniform to brownish, long dorsal and anal lobes dark quaker-drab. Ventrals sooty. Iris pale yellowish. Pectoral and caudal pale brownish. Vertical band through eye dark quaker-drab, another includes pectoral base and a third just before caudal peduncle. Length, 128 mm. Zamboanga.

Another, young example 33 mm. long from same locality. Head, 2⅔; depth, 1; D. V, 37; A. III, 27; tubes 46 in lateral line to caudal base; snout, 3 in head; eye, 2⅘; maxillary, 3⅓; interorbital, 2⅞. Preopercle edge with 6 or 7 points. Color in alcohol with dark bands on body much narrower than in larger examples, second only distinct on back, third as narrow dark band connecting front of soft dorsal and anal, fourth as two dark blotches at last dorsal and last anal rays, and fifth as basal caudal band. Caudal and pectoral whitish.

Family CHAETODONTIDAE.

CHAETODON CHRYSOZONUS Cavier.

Head, 3⅗; depth, 1½; D. XIII, 22, I; A. III, 18, I; 32 scales between between gill-opening and caudal base; 7 scales above lateral line to spinous dorsal origin, 15 scales below lateral line to spinous anal origin; snout, 2⅞ in head from upper jaw tip; eye, 3⅕; maxillary, 4; interorbital, 3½. Gill-rakers, 6+11 weak, slender points, about one-sixth of gill-filaments, which 1⅞ in eye. Scales with 11 basal radiating striae, apical denticles 106 to 105, circuli very fine. Color in alcohol faded dull brown, pockets of trunk showing obscure oblique streaks inclined posteriorly. Broad blackish band from close before spinous dorsal origin down including eye and across cheek. Upper soft dorsal edge and lower anal edge narrowly blackish. Caudal with broad white edge behind, with submarginal blackish band slightly lunate, close to broad pale yellowish band. Iris dark slaty. Length, 94 mm. Cebu.

CHAETODON PUNCTATO-FASCIATUS Cuvier.

Head, 3⅖; depth, 1½; D. XIII, 22, I; A. III, 18, I; 32 scales between gill-opening and caudal base; tubular scales 35 in lateral line to below last dorsal rays; 9 scales above lateral line to spinous dorsal origin, 16 below to spinous anal origin; snout, 3 in head from upper jaw tip; eye, 3; maxillary, 4⅓; interorbital, 3⅛. Gill-rakers, 6+14 weak slender, points, about one-fifth of gill-filaments, which 1⅓ in eye. Scales with 11 to 13 basal radiating striae, apical denticles 78 to 109, circuli very fine. Color in alcohol faded dull brown generally. About seven more or less deep blackish-brown vertical bands, median widest, extending on dorsals. Each scale of trunk with rounded dusky-brown spot. Small rounded black spot on predorsal close to spinous dorsal origin. Pale band from close above eye to its upper edge, margined with deep brown, also continued below eye across cheeks. Soft dorsal edge broadly pale, with submarginal white line, then blackish one and outer portion of fin dusky. Soft anal similar, only without dusky. Caudal broadly whitish behind, with outer submarginal blackish crescent. Iris slaty. Length, 93 mm. Cebu.

CHELMON ROSTRATUS (Linnaeus).

Head, 2⅓; depth, 1⅗; D. IX, 26; A. III, 19; 48 scales between gill-opening and caudal base; 38 tubular scales in lateral line to caudal base; 10 scales above lateral line to spinous dorsal origin, 23 below to spinous anal origin; snout, 1⅞ in head from upper jaw tip; eye, 5; maxillary, 2⅗; interorbital, 5⅗. Gill-rakers, 5+7 short rudimentary points, barely one-sixth of gill-filaments, which 1⅗ in eye. Scales with 10 to 14 basal radiating striae, apical denticles 70 to 76, circuli fine. Color in alcohol generally pale brown, with four slightly paler bands vertically. First from front preorbital through eye and narrow, and last from each soft vertical fin broadest, all margined narrowly with dark brownish. Within last on soft dorsal round black spot, little less than eye. Deep blackish-brown band vertically on caudal peduncle margined in front and behind with paler. Soft dorsal and anal edges broadly grayish, inner portion of which area forming slightly deeper submarginal band. Ventral deep brown, edge pale behind. Pectoral and caudal pale. Length, 113 mm. Cebu.

Family ACANTHURIDAE.

HEPATUS MATOIDES (Valenciennes).

Head, 3; depth, 1⅘; D. VIII, 26; A. III, 24; snout, 1⅗ in head; eye, 3; maxillary, 3⅖; interorbital, 3. Teeth uniserial, compressed, edge of each dentate. Color in alcohol with trunk nearly benzo-brown. Dorsals, anals, and ventrals blackish. Caudal edges above and below, and base, pale brownish, pale vertical band basally, and rest of fin blackish brown. Pectoral pale. Iris slaty. Length, 80 mm. Cebu.

Compared with Hawaiian examples in the Academy.

CTENOCHAETUS STRIATUS (Quoy and Gaimard).

Head, 3⅕ to 3⅖; depth, 1⅘ to 2; D. VIII, 26 or 27; A. III, 25 or 26; snout, 1⅓ to 1⅔ in head; eye, 3⅕ to 3⅘; maxillary, 3 to 3⅓; interorbital, 3 to 3⅕. Teeth slender, pediculate, apical expansion entire on inner edge, dentate on outer. Color in alcohol nearly uniform natal-brown on trunk, vertical fins darker to dusky. Trunk with numerous horizontal and slightly waved abscure dull blue-gray lines. Five examples, 125 to 155 mm. Zamboanga.

ACANTHNURNS ANNULATUS (Quoy and Gaimard).

Head, 3⅘; depth, 2⅖; D. VII, 28, I; A. II, 26, I; snout, 1½ in head; eye, 3¾; maxillary, 4; interorbital, 3⅕. Color in alcohol with back sepia, fading to nearly tawny-olive below. Dorsals dusky sepia, become blackish submarginally, fin edge narrowly whitish. Anals paler dusky, with three longitudinal deeper lines, parallel and whole length of fin, edge narrowly whitish. Caudal with broad whitish edge behind. Pectoral brown, edged paler all around. Ventral brownish, paler basally. Iris dusky. Length, 245 mm. Cebu.

This specimen agrees with Gunther's figure of *Naseus marginatus*[14] in the contour of its upper profile, based on an example from Aneiteum. The complete figure is from a Pelew example and its color pattern agrees in every respect with our specimen.

Family SIGANIDAE.

SIGANUS JAVUS (Linnaeus).

Head, 3⅓; depth, 2; D. I, XIII, 10, I; A. VII, 9, I; snout, 2 in head; eye, 3; maxillary, 3⅔; interorbital, 3. Teeth rather elongate, upper slightly tridentate or with front prong only slightly smaller than median or main prong, while hind denticle very small or nearly obsolete, also more terminal on tooth. Lower teeth biserial, similar, except small terminal obsolete denticle not present and in each case median denticle forward. Scales minute, simple, elongate, circuli very fine, nonstriate. Color in alcohol dull brownish generally, scarcely paler below. Vertical fins and ventrals brownish, all with more or less dusky terminally. Pectoral pale. Length, 133 mm. Cebu.

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[14] Journ. Mus. Godeffroy, vol. 4, 1875, p. 122, pl. 83, fig. a.

Compared with Philippine examples in the Academy.

SIGANUS FUSCESCENS (Houttuyn).

Head, $3\frac{7}{8}$; depth, $2\frac{3}{8}$; D. I, XIII, 10, I; A. VII, 9, I; snout, $2\frac{3}{5}$ in head; eye, $3\frac{1}{5}$; maxillary, $3\frac{1}{2}$; interorbital, 3. Teeth and scales as in preceding. Color in alcohol faded dull brownish generally, scarcely paler on abdomen. Dorsals and anals dark gray, mottled or obscurely blotched with darker on membranes, also on caudal, though traces of about five outer marginal darker blotches on each lobe most distinct. Paired fins pale. Ventral membrane dusky. Length, 155 mm. Cebu.

Agrees with Philippine material in the Academy.

SIGANUS ROSTRATUS (Valenciennes).

Head, $3\frac{7}{8}$ to 4; depth, $2\frac{3}{5}$ to $2\frac{5}{8}$; D. I, XIII, once XII, 10, I; A. VII, 9, I; snout, $2\frac{2}{5}$ to $2\frac{3}{5}$ in head; eye, $3\frac{1}{4}$ to $3\frac{5}{8}$; maxillary, $3\frac{7}{8}$ to 4; interorbital, 3 to $3\frac{1}{4}$. Teeth and scales as in *S. javus*. Caudal strongly forked. Color in alcohol dusky-brown generally, often clouded white on ventral region and lower surface also frequently pale vinaceous-drab. Spinous dorsal grayish, blotched with purple-drab, likewise spinous anal and ventral. Other vertical fins grayish, with brownish cloudings or specklings. Pectoral pale olive. Iris yellowish-white. Length, 138 to 163 mm. Four from Zamboanga.

Our examples apparently young. They agree fairly with Gunther's figure of *Teuthis rostrata*[85] from an example obtained at Tahiti. Traces of the numerous gilded small spots are still evident. Quite characteristic are the 3 or 4 large dark blotches on the ventrals.

SIGANUS CORALINUS (Valenciennes).

Head, $3\frac{3}{5}$ to $3\frac{1}{2}$; depth, 2 to $2\frac{1}{8}$; D. I, XII to XIV, 9, I, or 10, I; A. VII, 8, I; or 9 I; snout, $1\frac{7}{8}$ to $1\frac{9}{10}$ in head; eye, $3\frac{3}{5}$; maxillary, $3\frac{4}{5}$ to $3\frac{7}{8}$; interorbital, $3\frac{1}{8}$ to $3\frac{1}{4}$. Teeth and scales as in preceding species. Inner ventral spine, as depressed, very slightly less than outer. Color in alcohol nearly brownish-drab above, little paler below. Head, breast, belly, and ventral edge with moderate crowded dark edged gray ocelli, which much smaller and more or less as dark dots on trunk. Fins olive-gray, sometimes few obscure small clouded blotches on rayed vertical ones basally. Iris pale yellowish white. Length, 188 to 790 mm. Two from Zamboanga.

Compared with Sumatran example in the Academy.

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[85] Journ. Mus. Godeffroy, vol. 2-3 (5-6), 1874, p. 89, pl. 60.

SIGANUS VULPINUS (Schlegel and Müller).

Head, 3¼ to 3⅗; depth, 2¼ to 2⅓; D. I, XIII, 11, rarely 10; A. VII, 9; snout, 1⅞ to 2 in head; eye, 3⅘ to 4¾; maxillary, 5 to 5⅓; interorbital, 3⅘ to 3⅚. Teeth and scales as in preceding. Inner ventral spine about seven-eighths of outer. Color in alcohol, with back nearly burnt-umber, fading pale brown below and behind, especially on dorsals, anals, and caudal. Upper half of head, including snout, from slightly below maxillary end to lower eye edge then to suprascapular and spinous dorsal origin bone-brown. All of breast and chest before pectoral and ventral bases deep bone-brown. Lower half of head pale lavender-gray, finely dotted with bone-brown and as gray color extends over front of back, gradually fading after pectoral, also finely dotted. Pectoral tinted olive-gray, upper edge dark and similar tints on rayed vertical fins. Iris pale yellowish white. Length, 193 to 230 mm. Four from Zamboanga.

Jordan and Seale's figure[36] does not show the fine dark dots on the lower surface of the head, evidently having faded out.

We give *Lo* Seale only subgeneric rank, as in dentition, gill-rakers, and scale structure it agrees with all the other species we have examined. Its sole distinction appears to be in the constricted lower branchial region. Jordan and Seale say[37] it "is defined by the short tubular snout," which is not at all the case. The snout is, in fact, as long as most of the long-snouted species we have seen. From *Siganus corallinus*, for instance, its branchial construction is only a condition of slightly greater restriction.

Family BALISTIDAE.

BALISTAPUS LINEATUS (Schneider).

Head, 2⅚ to 2⅞; depth, $1\frac{9}{10}$ to 2; D. III—II, 24; A. I, 22 or 23; scales, 46 between gill-opening and caudal base and 4 more on latter; 25 to 29 scales between soft dorsal and anal origins; 38 to 47 predorsal scales; snout, 1⅓ in head; eye, 5¾ to 6; interorbital, 4 to 4⅓. Color in alcohol generally nearly bone-brown. Trunk with many inclined paler lines, extend from dorsal surface backwards toward anal and caudal. Several from muzzle with more or less yellowish white tinge. Spinous dorsal dark like back. Fins largely dull yellowish-white, narrow basal portion of each dorsal and anal ray, also of pectoral, bone-brown. Iris pale slaty. Length, 160 to 220 mm. Two from Zamboanga.

The larger example shows three rows of antrorse spines on each side of caudal peduncle, the smaller has only two.

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[36] Bull. Bur. Fish. U. S., vol. 25, 1905 (1906), p. 361, fig. 67.

[37] Idem, p. 360.

Family TRIACANTHIDAE.

TRIACANTHUS BLOCHI Bleeker.

Head, 3⅕; depth, 2⅗; D. V—22; A. 16, I; snout, 1⅓ in head; eye, 3; interorbital, 3⅓; first dorsal spine, 2¼ in combined head and trunk, greater than greatest body depth; second dorsal spine about 4⅗ in first; ventral spine 1⅒ in head, reaches anal; caudal peduncle length, 1⅓ in dorsal base. Color in alcohol faded dull brownish, little paler below. Iris pale slaty. Length, 74 mm. Cebu.

Our example appears to agree best with Bleeker's figure.[38]

Family TETRODONTIDAE.

SPHEROIDES SPADICEUS (Richardson).

Head, 2¾ to 3; depth (contracted), 3¼ to 3⅓; D. II, 10 to 12; A. II, 9 to 11; snout, 2 to 2⅛ in head; eye, 3¼ to 3⅝; interorbital, 2⅓ to 2⅝. Interorbital and front predorsal region until about overdepressed pectoral middle, also all of belly before vent and level with lower pectoral edge, spinescent, though spines on abdomen larger and less crowded. Color in alcohol with back grayish-olive, variably paler to dusky. Fins all pale brownish. Sides silvery-white from below eye, belly and lower surface white. Iris pale yellowish-white. Length, 50 to 160 mm. Twenty-five from Takao.

Family SCORPAENIDAE.

RHABDOSEBASTES, new genus.

Type.—*Sebastes stoliczkae* Day.

This genus is allied with the rose fishes, *Sebastes*, but differs in the possession of fifteen dorsal spines and the much smaller scales. *Sebastopsis* Gill has thirteen dorsal spines but no palatine teeth.

'Ράβδος, streak; *σεβαιστός*, magnificent, hence *Sebastes*.

RHABDOSEBASTES STOLICZKAE (Day).

Head, 2⅓; depth, 3; D. XIV, 10; A. III, 5; P. 12; V. I, 5; scales along and close above lateral line 34 to caudal base and 4 more on latter; tubular scales 37 in lateral line to caudal base and 4 more on latter; 4 scales above lateral line to soft dorsal origin, 12 below to spinous anal origin; 22 predorsal scales; head width, about 2 in its length; head depth at occiput, 1⅗; mandible, 2⅓; third dorsal spine, 2⅓; second dorsal ray, 2; second anal spine, 1⅗, first branched anal ray, 2⅓; least depth of caudal peduncle, 4¼; caudal fin, 1⅓; pectoral, 1⅓; ventral, 1⅗; snout, 5⅓ in head from upper jaw tip; eye, 3⅓; maxillary, 2⅗; interorbital, 6⅓.

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[38] Atlas Ichth., vol. 5, 1865, p. 89, pl. (8)·217, fig. 1.

Body elongate, well compressed, deepest about midway in its length, back not elevated. Caudal peduncle well compressed, length about four-fifths its least depth.

Head large, compressed, slightly flattened sides converge moderately upward. Snout very short, convex over surface and slightly so in profile, length about three-fifths its width. Eye large, ellipsoid, hind edge about midway in head length. Maxillary oblique, extends down until about midway in eye length, expansion 2⅙ in eye. Mouth moderate, closed jaws about even. Bands of villiform teeth in jaws, on vomer and palatines. Upper inner buccal fold broad, lower very narrow. Tongue large, smooth, fleshy, depressed, pointed, free around edge and in front. Front nostril above eye, close before front eye edge, with cutaneous expanded fleshy flap 2⅜ in eye, edge scarcely fringed. Hind nostril simply pore close above upper eye edge and slightly before front pupil edge. Interorbital slightly convex, little more than half of eye. Preorbital very narrow, much narrower than maxillary, which only partly slips below. Preopercle edge finely serrate and its lower edge with three moderately large antrorse spines. Opercle with strong flattened spine, 2½ in eye.

Gill-opening extends forward nearly opposite front eye edge. Gill-rakers, v+xii, low rudiments or tubercles, greatly lower than gill-filaments, which 2¼ in eye. Pseudobranchiae long as gill-filaments. Isthmus narrowly constricted forward, scaled.

Scales large, in oblique rows on trunk, etenoid, with 10 or 11 basal parallel marginal striae, apical denticles about 58 to 74 and circuli fine. Slightly smaller scales on soft dorsal, anal, pectoral and caudal bases, though scarcely smaller along body edges. Head, except maxillary, lips and preorbital, covered with small scales. Seven rows of scales across cheek from lower eye edge to preopercle angle. Lateral line on small and largely concealed scales, with simple tubes, its course largely concurrent with dorsal profile.

Spinous dorsal inserted little before pectoral origin, though slightly behind hind preopercle edge. Dorsal spines graduated down from third, which highest, second and fourth about equal, and first very slightly shorter than fourteenth, fin membranes deeply notched marginally. Soft dorsal origin nearly midway between hind end of opercle flap and caudal base, second ray longest, first subequal and all others graduated shorter. Spinous anal origin near last third in space between ventral origin and caudal base, second spine longest, third much shorter though depressed slightly beyond caudal base and first about one-sixth of second. Soft anal with first ray longest, though much shorter than second anal spine, and rays graduated down to hindmost. Caudal rounded behind. Pectoral rounded, extends slightly over halfway to anal. Ventral inserted entirely behind pectoral base, depressed fin falling very slightly short of vent or about two-thirds to anal, spine about two-thirds of fin.

Color in alcohol largely snuff-brown, variegated with markings of deep to warm sepia. Lower surface of body paler. Head above marked with rather small obscure spots of sepia. Muzzle generally pale, with four deep sepia blotches on maxillary and about three on mandible each side. Nasal tentacle dark. Iris dull slaty. On trunk ill-defined blotch below front of spinous dorsal, another about midway in its length and third one below soft dorsal, though former two more or less reflected on fin. Spinous dorsal entirely blotched with sepia. Fewer, though larger sepia blotches on soft dorsal. Anal with three broad bands of sepia, four on caudal, five on pectoral, and four on ventral. Pectoral axil pale, also inside gill-opening. Length, 108 mm. Cebu.

Our specimen agrees largely with Day's[39] account and figure. No specimen other than ours appears to have been secured since, and as it shows some minor variations we have given the above description. Our example shows the dark bands and blotches on the soft vertical fins more pronounced and contrastedly wide on caudal. Its spots on the spinous dorsal are also quite distinct and numerous.

PTEROIS HETERURA Bleeker.

Head, 2½ to 3¾; depth, 3⅕ to 3¼; D. XII, I, 9, I; A. II, 7, I, rarely 6; scales, 43 mostly according to pockets counted along close to lateral line to caudal base and 3 more on latter; 6 scales above lateral line to front of spinous dorsal, 11 below to spinous anal origin; snout, 2⅜ to 3 in head from upper jaw tip; eye, 3 to 3⅕; maxillary, 2 to 2⅛; interorbital, 5 to 6. Gill-rakers, IV, 2+10 II, lanceolate, longest equal gill-filaments or 2¾ in eye. Scales with 9 to 11 basal radiating striae, apical denticles weakly 5 to 7, circuli very fine. Color in alcohol largely faded dull brownish with traces of about five double sets of vertical slightly darker cross bands. On cheek three dark vertical bands from pupil. Dorsals light brownish, caudal and anals paler and all rayed portions finely spotted on rays with dark brown. Pectoral and ventral blackish, former with about eight to ten transverse pale vertical bands. Numeral blotch dusky-brown. Branchiostegal region tinged dusky. Length, 73 to 148 mm. Thirteen from Takao.

Bleeker's figure does not show the very prominent cutaneous predorsal flap, in some of our smaller examples nearly twice the eye in length. In our largest specimen the produced long caudal filaments render the tail equal to the rest of the body with the exception of the snout, thus greatly longer than Bleeker indicates. These two characters, together with the large scales, contrasted dark paired pale unpaired fins, constantly two anal spines and reduced radial formula, will serve to distinguish this species. It has not previously been recorded from Formosa.

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[39] Fishes of India, vol. 1, 1875, p. 148, pl. 36, fig. 1. Nicobars.

APISTUS CARINATUS (Schneider).

Head, $2\frac{3}{5}$; depth, $3\frac{1}{3}$; D. XIV, I, 9, i; A. III, 7; scales (mostly fallen) about 55?, in lateral line to caudal base; 6 scales above lateral line to third dorsal spine base; 16 scales below lateral line to spinous anal origin; 6 predorsal scales to occiput; snout, $3\frac{7}{8}$ in head; eye, $3\frac{3}{4}$; maxillary, $2\frac{1}{8}$; interorbital, $7\frac{1}{2}$. Gill-rakers, iii, 5+15, ii, lanceolate, $2\frac{1}{2}$ in eye; gill-filaments three-fourths of gill-rakers. Scales with 4 or 5 basal radiating striae, strong apical denticles 3 with median largest, circuli moderate. Color in alcohol pale brownish generally to nearly whitish below. Dorsals pale brown with large black blotch on posterior half of fin and two black bands on soft fin. Caudal pale, with three transverse dusky bands. Pectoral largely black, its uppermost ray white. Ventral and anal dusky terminally. Length 57 mm. Takao.

Quite likely *A. evolans* Jordan and Starks and *A. venenans* Jordan and Starks, each based on only one example, are simply variants of the present species. The elongated pectoral of our example, which reaches slightly beyond the caudal base, is doubtless a condition of youth.

MINOUS TRACHYCEPHALUS (Bleeker).

Head, $2\frac{1}{8}$; depth, 3; D. IX, 9; A. III, 7; snout, $2\frac{5}{8}$ in head from upper jaw tip; eye, $4\frac{1}{4}$; maxillary, $2\frac{1}{6}$; interorbital, $5\frac{1}{6}$; $1\frac{1}{4}$ in eye; pectoral, $2\frac{1}{3}$ in combined head and trunk or about 3 in total length. Gill-rakers, 3+7, robust, ends tuberculate, equal gill-filaments or $2\frac{1}{2}$ in eye. Color in alcohol largely dull fuscous, marked obscurely with darker blotches. Under surface whitish, dusted in places with dots of drab or ecru, especially on sides of head. Fins dark, terminal portions of pectoral and ventral and anal, fuscous-black. Length 60 mm. Takao.

Our example agrees with Bleeker's figures,[40] the species having originally been obtained at Celebes. Our specimen shows the maxillary extending little more posteriorly, though not quite opposite the front pupil edge. Though it has the caudal base pale there are no dark bands as in his figure of *M. monodactylus*.[41] *M. adamsi* Richardson has been taken from the synonymy of *M. monodactylus* by

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[40] Atlas Ichth., vol. 9, 1877, pl. (5) 415, fig. 4.

[41] Idem, pl. (2) 412, fig. 2.

Jordan and Starks,[42] where it had been placed by Gunther,[43] after a comparison of the type of *M. monodactylus* with adequate materials for the time, from Borneo and Madras, as well as China. We hardly feel this is justified, even in view of the contention for a different faunal area, unless Gunther's action can be properly shown to be unsound.

Family DACTYLOPTERIDAE.

EBISINUS CHEIROPHTHALMUS (Bleeker).

Head, 3⅓ to 3⅜; depth, 4¾ to 4⅝; D. I—I—IV—8; A. 6; scales, 44 to 46 in lateral series to caudal base and 2 more on latter; 22 or 23 scales between soft and dorsal and anal origins; snout, 2⅝ to 3 in head; eye, 2⅘ to 3; maxillary, 2 to 2⅓; interorbital, 1⅝ to 2, deeply convex. Along each side of lower body edge posteriorly 3 projecting lobate keeled scales, first about midway in anal. Color in alcohol nearly hair-brown with six transverse obscure nearly chaetura-black blotches, fifth and sixth of which with paler centers. First band across interorbital, second on occiput and last on caudal peduncle. First dorsal spine and pectoral blackish, dorsals otherwise and caudal brownish. Ventral and anal paler. Caudal with three transverse dark bands, soft dorsal with about six. Few pale brown spots on each anal ray. Iris pale yellowish white. Length, 107 to 125 mm. Three from Takao.

Family PLATYCEPHALIDAE.

THYSANOPHRYS NEMATOPHTHALMUS (Gunther).

Head, 2⅞; depth, 7⅘ to 8½; D. I, VIII—I, 10, i; A. 11, I; scales, 98 counted close along and above lateral line to caudal base, and 9 more on latter; tubular scales 53 or 54 in lateral line to caudal base and 2 more on latter, unarmed; 9 or 10 scales above lateral line to soft dorsal origin, 22 to 24 scales below to anal origin; 16 or 17 predorsal scales; 2 preopercle spines; snout, 3 to 3⅛ in head from upper jaw tip; eye, 5⅓ to 6; maxillary, 2½; interorbital, 6¼ to 6½; 3 supraorbital tentacles, median long at eye and single flat tentacle below preopercle angle. Gill-rakers, v, 1+5, IX, lanceolate, equal gill-filaments or 2 in eye. Scales with 16 to 20 radiating basal striae, apical denticles about 30 and circuli moderately fine. Color in alcohol dark vandyke-brown, with about eight obscure saddlelike blotches of darker, merging along lower side into many broken and incomplete reticulate blotches. Dusky vandyke-brown blotch belo weye across cheek. Dorsals like back, finely reticulated with pale or whitish, likewise caudal, which also with four obscure dark vertical bands. Pectorals like dorsals, but with blackish blotches basally. Ventral pale basally, dusky to blackish terminally, where also marked with whitish reticulating lines. Anal largely whitish, with dusky to blackish subterminal blotch on each membrane. Iris brownish, with dusky blotch above. Length, 230 to 257 mm. One from Cebu and one from Zamboanga, respectively.

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[42] Proc. U. S. Nat. Mus., vol. 27, 1904, p. 151.

[43] Cat. Fish. Brit. Mus., vol. 2, 1860, p. 148.

THYSANOPHRYS MACRACANTHUS (Bleeker).

Head, 2½ to 2⅞; depth 7 to 7½; D. I, VIII—i, 11; A. 12; scales, 82 or 83 counted close along and above lateral line to caudal base and 6 more on latter; tubular scales 51 or 52 in lateral line to caudal base and 3 more on latter; 19 to 22 spines anteriorly in lateral line; 7 or 8 scales above lateral line to soft dorsal origin, 14 or 15 below to soft anal origin; 10 or 12 predorsal scales; 2 spines at preopercle angle, lower equals eye and 2 more short ones below; snout, 3¼ to 3½ in head from upper jaw tip; eye, 3¾ to 5; maxillary, 2⅓ to 2½; interorbital, 3¾ to 4⅓; bony interocular, 2 to 3 in eye. Gill-rakers v or vi, 1+5 or 6, vi, lanceolate, 2 in eye and gill-filaments about three-fourths of gill rakers. Scales with 5 to 8 basal radiating striae, 28 to 48 apical denticles and circuli moderately fine. Color in alcohol with back cinnamon-drab and about 5 obscure slightly darger blotches or saddles on back. Lower surface white. Dorsals brownish, spotted with dusky. Caudal dark brownish, dusky terminally. Lower pectoral rays and ventral terminally dusky-black, upper pectoral rays with six or more transverse dusky bands. Anal pale like belly. Iris yellowish-white. Length, 48 to 183 mm. Five from Takao.

THYSANOPHRYS TUBERCULATUS (Cuvier).

Head, 2⅓ to 2⅗; depth, 5¼ to 5¾; D. I, VIII—i, 11; A. 11; scales, 60 counted close along and above lateral line to caudal base and 5 more on latter; 10 or 11 spinous scales along front part of lateral line, 22 in young; tubular scales 50 to 52 in lateral line to caudal base; 6 or 7 scales above lateral line to soft dorsal origin, 14 or 15 below to anal origin; 7 predorsal scales to occiput; snout, 3⅒ to 3⅓ in head from upper jaw tip; eye, 3¾ to 4; maxillary, 2⅓ to 2⅗; interorbital, 4¼ to 4¾; bony interorbital, 2½ to 3½ in eye. Gill-rakers v, 1+6, vii, lanceolate, 3 in eye and gill-filaments three-fourths of rakers. Scales with 4 or 5 basal radiating striae, apical denticles 18 or 19, strong and circuli moderate. Two spines at end of preoprecle. Color in alcohol nearly hair-brown above, with seven slightly darker obscure blotches, below whitish. Spinous dorsal with three blackish horizontal bands, soft dorsal with four, caudal with about five. Lower half of pectoral blackish, margin whitish, and upper half pale or whitish with five transverse blackish bands. Ventral largely blackish terminally, edge narrowly pale or whitish. Iris dull yellowish-white. Young much more spotted or speckled with dark brown above, and serrae and spinules on head much more prominent. Length, 62 to 105 mm. Three from Takao.

Day's figure of *Platycephalus tuberculatus*[44] shows the soft dorsal and anal with fine longitudinal or inclined narrow bands. In our specimens these are all very much broader and contrasted. Moreover, the preopercular spine is variably long in our examples and may or may not extend over the gill-opening to the pectoral base.

Family PLEURONCETIDAE.

PSEUDORHOMBUS CINNAMOMEUS (Schlegel).

Head, $3\frac{2}{5}$; depth, $2\frac{1}{5}$; D. 77; A. 63; scales 88 counted close above along lateral line to caudal base and 5 more on latter; tubular scales 81 in lateral line to caudal base and 3 more on latter; 20 scales above lateral line arch to dorsal base, 36 below straight section anteriorly to anal base; snout 4 in head; lower eye, $5\frac{1}{3}$; maxillary, $2\frac{1}{3}$; pectoral, $1\frac{3}{5}$. Gill-rakers, 5+9 left, 3+8 right, lanceolate, slightly less than gill-filaments, which 2 in lower eye. Scales ctenoid on both sides of body; with 13 to 16 basal radiating striae, 18 to 23 apical denticles, moderately long and strong on left side; 16 to 21 basal radiating striae and 17 to 21 apical denticles on right side; all circuli fine. Color in alcohol with left side nearly army-brown, and very slight dark cloudings. Blotch obscurely at beginning of lateral line nearly bone-brown. Right side nearly tilleul-buff, and vertical fins all grayish terminally. Length, 212 mm. Takao.

Also ten young from the same locality. They show: Head, $4\frac{1}{5}$ to $4\frac{1}{4}$; depth, $2\frac{1}{2}$ to $2\frac{3}{5}$; D. 75 to 87; A. 65 or 66; scales fallen and pockets hardly distinguishable; snout to lower eye, 4 in head from upper jaw tip; lower eye, $3\frac{1}{3}$ to $3\frac{4}{5}$; maxillary, $2\frac{1}{2}$ to $2\frac{3}{5}$; pectoral, $1\frac{1}{3}$ to $1\frac{1}{2}$. Gill-rakers, left 2 or 3 + 7 or 8; right 0 to 2+6. Color in alcohol with left side pale brown, little variegated and right side pale to whitish. Length, 57 to 65 mm.

PSEUDORHOMBUS PENTOPHTHALMUS (Gunther).

Head, $3\frac{1}{4}$ to $3\frac{1}{3}$; depth, $1\frac{9}{10}$; D. 63 or 64; A. 47 to 49; scales, 70 or 71 counted close above along lateral line to caudal base and 5 more on later; 71 or 72 tubular scales in lateral line to caudal base and 18 more on latter; 13 or 14 scales above lateral line arch to dorsal base, 29 to 32 below to anal base; snout, 4 to $4\frac{1}{3}$ in head; lower eye, $4\frac{1}{3}$ to $4\frac{3}{5}$; maxillary, $2\frac{1}{3}$ to $2\frac{1}{5}$; pectoral, $1\frac{3}{5}$ to $1\frac{4}{5}$. Gill-rakers, 4+14 left, 5+15 right, lanceolate, long as gill-filament, or about 2 in eye. Scales with 12 or 13 basal radiating striae; apical denticles 18 to 22, left; right scales cycloid and basal radiating striae 10 to 17; circuli fine. Color in alcohol with left side nearly benzo-brown, mottled paler or slightly darker, many markings as rings. At least five rings nearly large as eye, two above and same below lateral line and posterior just before caudal peduncle. Also each sprinkled with minute white dots. Length, 108 to 130 mm. Five from Takao.

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[44] Fishes of India, vol 2, 1876, p. 275, pl. 60, fig. 5.

P. ocellifer Regan [45] is said to have the eye 3½ to 3⅜ in head, the main character of distinction from the present species.

SCAEOPS GRANDISQUAMA (Schlegel).

Head, 3¾ to 3⅘; depth, 1⅘ to 1⅝; D. 81 to 83; A. 60 to 62; scales (pockets) about 42 ? in lateral line to caudal base; snout, 4¾ to 5⅕ in head from upper jaw tip; eye, 3 to 3⅓; maxillary, 3⅕ to 3⅙; interorbital equals or slightly greater than eye; pectoral, 1⅓ to 1¼. Gill-rakers, 0+6 left, 0+5 right, lanceolately robust, equal gill-filaments or about 3 in eye. Scales very caducous, with about 56 to 58 basal parallel fine striae, minute apical denticles 36 to 38, circuli fine. Arch of lateral line about 3⅘ in straight section. Color in alcohol with left side nearly dull snuff-brown, obscurely speckled or clouded with darker or nearly bister tints. Fins grayish, speckled with darker. Right side very pale, tinted somewhat pinkish-buff. Fins grayish, with trace of a blackish blotch on each of upper and lower caudal rays medially. Length, 50 to 82 mm. Seventeen from Takao.

Quite likely *Scaeops kobensis* Jordan and Starks [46] based on a single example, 83 mm. long, from Kobe, is synonymous.

PARDACHIRUS PAVONINUS (Lacépède).

Head, 4⅓; depth, 2½; D. 64; A. 50; tubular scales 80 in lateral line to caudal base; about 33 scales above lateral line to dorsal base, 37 below to anal base; snout measured to upper eye, 3⅓ in head; upper eye, 6¼; maxillary, 2½; interorbital, 5. Scales with 34 to 42 radiating basal striae, apical denticles 5 to 7. Color in alcohol with right side nearly warm sepia, marked with innumerable dusky to blackish variable rings, many with black central dot. Rings smaller and more crowded along fins marginally. Left side pinkish-buff, fins becoming grayish marginally. Length, 180 mm. Zamboanga.

LIACHIRUS NITIDUS Gunther.

Head, 3⅝ to 4⅕; depth, 2⅙ to 2⅕; D. 50 to 62; A. 45 to 48; tubular scales 72 to 80 in lateral line to caudal base; 22 to 25 scales above lateral line to dorsal base, 30 to 33 below to anal base; snout measured to upper eye, 3¼ to 4⅓ in head; eye, 5½ to 6¾; mouth gape, 3⅙ to 3⅝; interorbital, 4¼ to 6. Scales cycloid, with 37 to 44 basal radiating striae and circuli moderately fine. Color in alcohol with right side nearly fuscous with innumerable fine close fuscous-black to black blotches or specks. Spots rather sparsely on fins, at least terminally. Left side nearly opaque white, with few grayish cloudings. Fins all grayish. Length, 72 to 103 mm. Three from Takao.

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[45] Ann. Mag. Nat. Hist. London (7), vol. 15, 1905, p. 25. Inland Sea, Japan.

[46] Proc. U. S. Nat. Mus., vol. 31, 1907, p. 170, fig. 2.

Though our examples differ greatly in their coloration from the figure given by Jordan and Evermann,[47] it is evident their specimen was faded, leaving only a few blackish spots. Our examples show the upper eye slightly more advanced.

CYNOGLOSSUS ROBUSTUS Gunther.

Head, 4½ to 4⅓; depth, 3⅞ to 4⅓; D. 95 to 115; A. 75 to 82; scales, 56 ? to 60 (mostly fallen) in median lateral line from gill-opening to caudal base; 6 to 8 scales above median lateral line to uppermost lateral line; 10 or 11 scales below median lateral line to anal base; snout, 2¾ to 3⅓ in head, as measured from upper eye; upper eye, 7¼ to 10¾. Scales with 26 to 60 basal radiating striae, apical denticles on left side, 22 to 27; scales on right side with about 66 basal radiating striae, and no denticles; all circuli fine. Color in alcohol with left side and fins nearly dull wood-brown, and very dull cloudings of darker. Right side pale, pinkish-buff to vinaceous-buff, fins pale. Length, 82 to 184 mm. Three from Takao.

Cynoglossus diplasios Jordan and Evermann[48] is certainly very closely related if not synonymous. It is said to be distinguished by the presence of two well developed complete lateral lines on either side. In our examples we can not confirm this character, as most of the scales have fallen, though there are enough present on the left side to show that both are there evident.

Jordan and Starks give D. 122 to 127 and A. 96 to 100 for *C. robustus*,[49] and scales 69 to 71 as counted from the gill-opening and 10 between lateral lines at middle of the body. The figure of *C. diplasios*, as given by Jordan and Evermann, shows 13 between the lateral lines.

C. brunneus Regan is another closely related species from the Inland Sea of Japan, though even its fin and scale formula shows it within the limits of variation for *C. robustus*.

Family SILLAGINIDAE.

SILLAGO SIHAMA (Forskål).

Head, 3¼; depth, 6; D. XI—I, 20; A. I, 24; scales, 65 in lateral line to caudal base and 5 more on latter; 5 scales above lateral line to spinous dorsal origin, 10 below to spinous anal origin; 25

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[47] Proc U. S. Nat. Mus., vol. 25, 1902, p. 366, fig. 28. Giran.

[48] Idem, p. 367, fig. 29. Formosa.

[49] Idem, vol. 31, 1907, p. 288.

predorsal scales. Gill-rakers, 3+8, lanceolate, one-fourth of gill-filaments, which 2⅓ in eye. Cheek scales cycloid. Scales with 7 radiating basal striae, apical denticles 44 to 47 and circuli moderately fine. Color in alcohol faded largely pale uniform brownish. Soft dorsal gray-white, with few obscure grayish spots. Spinous dorsal with dusky dots terminally. Iris slaty. Length, 125 mm. Cebu.

SILLAGO JAPONICA Schlegel.

Head, 3⅗ to 3⅔; depth, 6 to 6⅛; D. XI, 21 or 22; A. I, 22 or 23; scales, 66 to 70 in lateral line to caudal base and 5 or 6 more on latter; 3 or 4 scales above lateral line to spinous dorsal origin, 10 below to spinous anal origin; 21 to 23 predorsal scales. Gill-rakers, 3+10, lanceoltate, slightly less than gill-filaments, which 3 in eye. Scales with 5 or 6 basal radiating striae, apical denticles 33 to 35, circuli moderate. Cheek scales ctenoid. Color in alcohol faded largely dull brownish, back, dorsals and caudals slightly darker. Length, 87 to 104 mm. Ten from Takao.

Though this species appears to differ in the alleged fewer scales above the lateral line to the spinous dorsal origin and the ctenoid cheek scales, it is very close to *S. sihama*.

Family OPHICEPHALIDAE.

OPHICEPHALUS STRIATUS Bloch.

Head, 3⅛ to 3⅕; depth, 5½ to 6⅔; D. 43; A. 26; scales, 54 or 55 in lateral line to caudal base and 3 more on latter; 4 scales above lateral line to dorsal origin, 7 below from posterior division of lateral line to anal origin; 14 or 15 predorsal scales; snout, 4⅛ to 5⅓ in head from upper jaw tip; eye, 5⅞ to 6; maxillary, 2½ to 2⅔; interorbital, 4 to 4⅛. Gill-rakers, about 11 low broad tubercles; gill-filament, 2 in eye. Scales with 17 or 18 basal radiating striae, 5 to 10 pronounced apical convergent circuli and other circuli moderate. Color in alcohol with sides and above chestnut-brown, darker above. Along sides of trunk mostly two parallel rows of rather large dark blotches of darker. These blotches variable, many as oblique streaks along sides of trunk. Fins grayish-brown with darker or dusky streaks on dorsal and anal. On caudal five or six transverse dark streaks, broader and darker basally. Pectoral pale brown, with dull olive tints and obscure dusky streaks. Ventral white, like lower surface of both head and trunk. Dark brown streak from infraorbital edge back toward preopercle angle. Length, 88 to 121 mm. Twenty-two from fresh water canal of St. Maria, Zamboanga. February 27, 1914.

Family GOBIIDAE.

RHINOGOBIUS GYMNAUCHEN (Bleeker).

Head, 3¼; depth, 4¼; D. VI—I, 9; A. I, 9; P. 20; V. I, 5; scales, 30 in median lateral series from gill-opening above to caudal base and 2 more on latter; 11 scales traversely between soft dorsal and anal origins; head width, 1½ in its length; head depth at occiput about 1½; snout, 3⅙; eye, 3⅖; maxillary, 3; interorbital, 6½; third dorsal spine, 1⅞; third dorsal ray, 1⅘; caudal, 1¼; third anal ray, 2⅓; pectoral, 1½ ventral, 1⅖; least depth of caudal peduncle, 2½.

Body rather robust, moderately compressed, apparently deepest about middle of spinous dorsal, edges all convex. Least depth of caudal peduncle 1¾ its length.

Head robust, slightly wider than deep, profiles convex and cheeks with slight swollen appearance. Snout convex over surface and in profile, length two-thirds its width at front eye edges. Eye large, ellipsoid, high, superior-lateral, and hind pupil edge slightly before center in head length. Mouth large, terminal, inclined moderately. Maxillary reaches opposite front eye edge. Lips rather broadly fleshy. Band of small simple conic teeth in each jaw and an outer series in each jaw enlarged and curved. No teeth on roof of mouth or on tongue. Latter wide, depressed, free and with convex edge in front. Inner buccal folds narrow. Mandible strong, rather deeply convex. Nostrils two simple pores, hind one little before last fourth in snout profile and front one nearly midway in snout profile. Interorbital narrowly convex ridge. Preorbital width slightly greater than pupil, though a little less than eye.

Gill-opening forward until about opposite last fourth in head. Gill-rakers, 1+5, lanceolate, short, barely half of gill-filaments, which about 3 in eye. Isthmus wide, level.

Scales large, well exposed, in even longitudinal rows on trunk. Head largely naked, only few small cycloid scales on opercles, mostly above. Lower cheek with four horizontal series of close-set pores, indistinct, two short parallel horizontal series across opercle above, vertical series close behind preopercle edge and horizontal series across opercle. Scales on predorsal and occipital region sparse, small, weakly cycloid and obsolete. Except rather small scales on caudal base, all other fins naked. Scales with 20 to 24 convergent basal radiating striae, apical denticles about 50, graduated larger above and below, and circuli fine.

Spinous dorsal inserted behind pectoral base. Fin, rounded and depressed, reaches back little beyond front of soft dorsal. Latter inserted little nearer caudal base than snout tip. Anal inserted opposite soft dorsal origin. Caudal rounded, likewise pectoral, and ventral nearly long as pectoral. Vent close before anal.

Color in alcohol pale avellaneous generally. Back and upper surface of head with many darker or brownish vermiculations, usually formed by pale apical spot on each scale. Along middle of side three obscure dusky blotches, first about middle of pectoral, second below soft dorsal, and third at caudal base. Fins all pale generally. Spinous dorsal with rather broad dusky to blackish streaks or blotches, little more inclined than spines. Soft dorsal with three to four rows of deep dusky rounded spots and fin edge dusky. Caudal similar. Anal whitish, edge dusky. Ventral pale. Eye pale brownish, pupil dusky, with metallic green luster.

Length, 91 mm. Takao, Formosa.

We give the above account as our example differs in a number of respects from a series of Japanese examples in the Academy. Also, the species does not appear to ever have been recorded from Formosa. In profile the Formosan example has a greatly obtuse muzzle with even jaws. In the Japanese examples the lower jaw of all strongly projects. In the Formosan example the spinous dorsal has dark vertical bands, whereas in the Japanese they are black spots like those on the soft dorsal, and in some cases the apical form horizontal bands. In all other respects the color pattern is such as may evolve from that of the Japanese examples, to that of the Formosan, as a change with age. This is also true of the pores on the cheek. In none of our examples do they resemble those in the figure by Jordan and Snyder for *Ctenogobius gymnauchen.*[50] In our Formosan example we believe much of the contrast in color pattern has faded during preservation.

RHINOGOBIUS CANDIDIUS (Regan).

Head, 2⅞ to 3; depth, 4½ to 5¾; D. VI—I, 8; A. 9; scales, 32 to 34 from gill-opening above to caudal base; 10 scales transversely between soft dorsal and anal origins; snout, 2⅞ to 3⅔ in head; eye, 3¾ to 4⅓; maxillary, 2⅙ to 2⅘; interorbital, 7½ to 8½. Tongue more or less convex in front. Gill-opening forward about opposite last fourth in head or to hind preopercle edge. Scales with 16 to 18 nearly parallel striae medio basally, apical denticles 23 to 25 in single row and circuli rather coarse. Maxillary variable, sometimes to eye front and again to its center. Color in alcohol largely dull brownish. Spinous dorsal with blackish basally, usually forward, and soft dorsal dusky medially. Often obsolete dark vertical bar at caudal base. Both soft and spinous dorsal edges pale. Length, 33 to 45 mm. Eight from Lake Candidius, Formosa. October 10, 1907.

Our examples usually have the predorsal naked, though in some it is more or less scaly.

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[50] Proc. U. S. Nat. Mus., vol. 24, 1902, p. 58, fig. 6.

EXYRIAS PUNTANG (Bleeker).

Head, 3⅓; depth, 3¾; D. VI—I, 10; A. I, 9, I; scales, 28 from gill-opening above to caudal base and 3 more on latter; 8 scales between soft dorsal and anal origins; 12 predorsal scales; snout, 3$\frac{1}{10}$ in head; eye, 4; maxillary, 2¾, interorbital, 2 in eye. Gill-rakers, 0+5, lanceolate, 1⅗ in gill-filaments, which 1⅓ in eye. Scales with 11 to 15 basal radiating striae, apical denticles 110 to 124 and circuli very fine. Color in alcohol, dull brown generally, little paler below, each scale with obscure pale spot. Spinous dorsal with deep dusky-brown spots, paler areas streaked with brown. Soft dorsal with five or six brown spots on each ray. Caudal with about fifteen or more narrow irregular dark cross bands. Pectoral similar, only paler. Anal darker marginally, and ventral darker on innermost rays. Length, 123 mm. Zamboanga.

OXYURICHTUS FONTANESII (Bleeker).

Head, 3⅗; depth, 6⅓; D. VI—I, 15, I; A. 17, I; scales, 104 in median lateral series from gill-opening above to caudal base and 10 more on latter; about 27 scales transversely at soft dorsal and anal origins; 30 predorsal scales; snout, 4⅓ in head from upper jaw tip; eye, 4⅘; maxillary, 2⅗; interorbital, 3½ in eye. Gill-rakers, 4+10, lanceolate, about two-thirds of gill-filaments, which 2⅘ in eye. Scales with 10 to 12 basal radiating striae, apical denticles 12 to 28, circuli moderate. Color in alcohol dull brownish generally. Five transverse obsolete dark cross bands or blotches, first at occiput, second at middle of spinous dorsal on which reflected, third at front of soft dorsal, fourth just before caudal peduncle and fifth at caudal base. Fins all pale brown. Lower anal edge dusky, with narrow pale or gray submarginal line. Innermost pair of ventral rays dark. Iris pale slaty. Length, 150 mm. Cebu.

Family BLENNIIDAE.

SALARIAS FASCIATUS (Bloch).

Head, 5; depth, 4; D. XI, 19; A. 20; snout, 2⅘ in head; eye, 3; maxillary, 2¼; interorbital, 2⅕ in eye. Bifid supraorbital tentacle fringed, 2 in eye. Two fringed occipital flaps, little longer than supraorbital tentacle. Nasal tentacle about half of supraorbital. No hind canines. Last dorsal ray joint caudal. Color in alcohol nearly olive-brown with about eight double dark vertical cross bands, reflected on dorsal fins above and last ones at least on anal below, on trunk posteriorly. Anteriorly horizontal dark lines, parallel and above finally broken into spots. Oblique dark shades or bands across dorsals, on spinous fin finely specked or dotted with deep brown, simply as series of parallel dusky bars on soft fin. Caudal with few dusky spots basally and pectoral largely spotted with dusky. Ventral with three dark blotches, one of which basal. Length, 120 mm. Cebu.

Family LOPHIIDAE.

LOPHIOMUS SETIGERUS (Vahl).

Head, measured to front edge of gill-opening, 1⅞; body depth 3 in head; D. I—I—I—I—II, 8; A. 7; snout, 2⅜ in head; maxillary, 1⅘; interorbital, 3⅕; eye, 2⅔ in interorbital. Second dorsal spine apparently high as first (tip slightly damaged). Lateral filaments moderate. Color in alcohol nearly bister above, variegated with obscure lighter spots and darker cloudings. Pectoral blackish terminally. Caudal dusky basally, outer portion pale. Tongue and surrounding branchial region inside mouth below blackish, with two rows of contrasted white spots. Under surface of body, including ventral and anal, white. Length, 67 mm. Takao.

Family ONCOCEPHALIDAE.

HALIEUTAEA STELLATA (Vahl).

Disk width, 1⅙ to 1½ in combined head and trunk; 4 to 4¾; D. 5; A. 5; P. 10; mouth width, 2⅔ to 3 in disk width; eye little greater than interorbital, about 8 in disk width; nasal cavity three-fourths to equal of eye diameter. Spinules on upper surface of disk three-rooted. Color in alcohol with lower surface nearly uniform pale olive-buff. Upper surface little darker brown, with nearly olive-brown cloudings about middle of disk. Caudal pale, with four brownish cross bars. Dorsal with dull brown shades, other fins whitish like belly. Length, 59 to 60 mm. Takao.

Our examples agree largely with one described by Jordan and Sindo.[51] Both differ, however, in the presence of more anal rays.

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[51] Proc. U. S. Nat. Mus., vol. 24, 1902, p. 380. Ajiro near Atami.

SEVEN NEW SPECIES OF FISH OF THE ORDER MALACOPTERYGII.

By W. W. Welsh,[1]

Scientific Assistant, United States Bureau of Fisheries.

The following descriptions of seven new Malacopterygian fishes have been taken wholly from the unpublished notes of Mr. W. W. Welsh, formerly scientific assistant, United States Bureau of Fisheries, whose most unfortunate demise has placed this work of salvage on me, as the one who was most recently collaborating with Mr. Welsh in the study of fishes.

All illustrations, except that of *Aristostomias tittmanni*, were prepared under the personal supervision of Mr. Welsh. That of *Aristostomias tittmanni* was made by Mrs. E. B. Decker, under the direction of Mr. S. F. Hildebrand. Those of *Eustomias proximus* and *bigelowi* were drawn by Mr. T. Van de Bogert, and the remainder are from my own pen. Mr. S. F. Hildebrand supplied the footnotes to the description of *Aristostomias tittmanni* and *Eustomias enbarbatus*.

C. M. Breder, Jr.

Family GONOSTOMIDAE.

Gonostomidae Goode and Bean, Oceanic Ichthyology, 1896, p. 97.

Genus DIPLOPHIS.

Diplophas Gunther, Journ. Mus. Godeffroy, vol. 2, 1873, p. 104.

DIPLOPHOS MOOREI, new species.

Three examples taken by the *Bache*, two, 43 and 33 mm. in length, at Station 10196, in the northeast Providence Channel, and one, 39 mm. long, at Station 10202, 5 miles west from Gun Cay, in the Straits of Florida. The first two were taken at the surface, the third in a haul at 75 to 0 meters.

This species differs markedly from known forms, in the shorter and deeper body, much lower anal count, and lesser number of photophores.

Dorsal, 12; caudal, 20; anal, 38; ventrals, 8; pectorals, 9.

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[1] Compiled and edited posthumously by C. M. Breder, Jr., fisheries expert, United States Bureau of Fisheries.

Head 5.24 (5.62 in length), compressed, acute, the upper and lower profiles equally oblique; body long, compressed throughout its length; greatest depth at pectoral, 7.86; eye 6.9 in head, circular, lateral; snout 4.93, pointed; mouth large, lower jaw projecting; maxillary 1.53, extending about 1½ eye diameters beyond vertical from posterior margin of eye, broadened posteriorly; jaws with teeth of moderate size; a few small teeth on vomer; palatines toothless; pseudobranchiae absent; interorbital 5.72, convex; body covered with large cycloid scales, 65 in the lateral line.

Light organs as follows: On the head, one small suborbital; two small black organs on cheek, one above end of maxilliary, the other midway between this and center of pupil; three opercular organs, two on the anterior border of preopercle, the upper on a level with center of eye, the lower at angle of mouth, the third on subopercle slightly above level of pectoral base; a small organ on mandible below and slightly in advance of suborbital; distal end of mandible glandular and apparently luminous; on body, three rows, the upper on lateral line, of 66 small, round photophores, the last of the series on base of caudal rays; second row slightly above level of pectoral, of 48 photophores, 2 before pectoral, 18 between pectoral and ventral, 13 between ventral and anal, and 15 extending along base of anal to above 23d ray; lower row, on branchiostegals 11, on isthmus to pectoral 13, pectoral to ventral 17, ventral to anal 12, anal to caudal 29, no gap in this series on caudal peduncle.

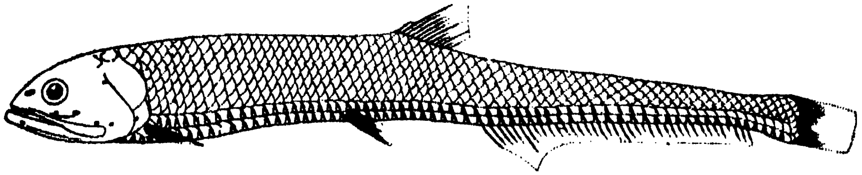

FIG. 1.—DIPLOPHOS MOOREI, NEW SPECIES.

Dorsal entirely in advance of anal, its origin in the middle of body length; distance from tip of snout to origin of dorsal 2, to anal 1.74, to ventral 2.41.

Color in alcohol, head and body clove-brown, the scales edged with darker, cheeks and maxilliary pale, punctulated with brown, mandible yellow at tip; dorsal and anal rays slightly pigmented at base; caudal finely punctulated with brown; ventrals and pectorals unpigmented.

Type.—Cat. No. 84293, U.S.N.M., 39 mm. long, taken in a townet at Station 10202, in the Gulf Stream, 5 miles west from Gun Cay, at a depth of from 75 to 0 meters.

(*moorei*, named for Dr. H. F. Moore, Deputy Commissioner United States Bureau of Fisheries.)

Family STOMIATIDAE Gunther.

Stomiatidae GUNTHER, Cat. Fish Brit. Mus., vol. 5, 1864, p. 424.

Genus ARISTOSTOMIAS Zugmayer.

Aristostomias ZUGMAYER, Bull. Ocean. Inst. No. 253, 1913, p. 1.

ARISTOSTOMIAS TITTMANNI, new species.

One example, 46 mm. in length, from Station 10161, 115 miles east from Cape Hatteras, at a depth of 100 to 0 meters.

This species appears to agree closely with the rather meager description of *A. grimaldii* Zugmayer,[2] but differs markedly in one respect. *A. grimaldii* is described as having a large preorbital light organ, as well as a suborbital organ. In *A. tittmanni* there is no preorbital organ. There is also a large ovoid light organ lying in a slit-like socket behind and below the level of the eye. There appear also to be minor differences. The description of *A. grimaldii* does not mention the lateral series of photophores.[3]

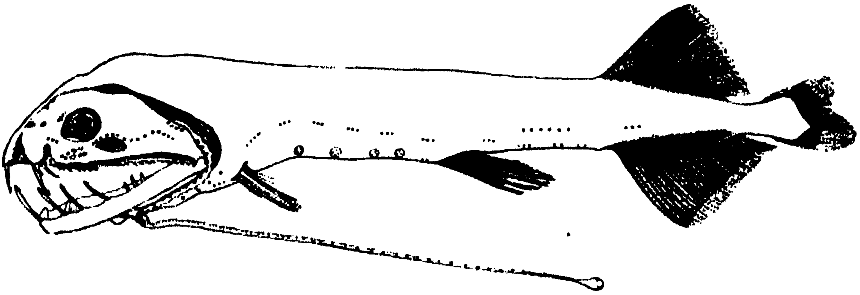

FIG. 2.—ARISTOSTOMIAS TITTMANNI, NEW SPECIES.

Dorsal, 22; caudal, 22; anal, 24; ventrals, 6; pectorals, 3, 5, or 8 (according to interpretion of the structure of the rays).

Head 3.40 (3.83 in total length), long, compressed, its width 3.43, its depth 1.85 in its length; body rather short, compressed, greatest depth 6.80 (7.66 in total length); eye subovate, lateral 6.66 in head; snout acute, projecting, 3.43; mouth deeply cleft; gill opening extending to a point above eye; maxillary 1.12, extending about 3 eye diameters behind vertical from posterior margin of eye; barbel long, filamentous, simple, ending in a smooth ovoid knob, its length 1.56 in length without caudal; teeth in both jaws in a single row, of unequal length; in the upper jaw two pairs of long, hollow canines, barbed at tip, followed by five pairs of much smaller teeth, recurved at tip; these are followed by 12 pairs of small straight recumbent teeth; in the lower jaw two pairs of large and five pairs of smaller canines, bladelike and barbed at tip, the first two pairs fitting in grooves on side of snout when mouth is closed; each of the larger fangs appears to have one or more rudimentary fangs at its base, and a minute pore at the tip, opening by a duct into the cavity of the tooth; tongue with two groups of strong retrorse teeth; palatines with four small teeth on each side; vomer toothless; interorbital space 4; body scaleless.

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[2] Bull. Inst. Ocean., No. 253.

[3] Attention should be directed to the rather close relationship of this species and *Grammatostomias dentatus* Goode and Bean, (Oceanic Ichthyology, 1895, p. 110, fig. 133). A comparison of the types reveals the following essential differences:

a. The greatest depth of the body in *G. dentatus* is nearly equal to the length of the head; in *A. tittmanni* it is only about half the length of the head.

b. In *G. dentatus* the eye and snout are of about equal length, while in *A. tittmanni* the eye is only about half as long as the snout. This is important, since the type of *A. tittmanni* is only 46 mm. long, while that of *G. dentatus* is 160 mm. in length. The difference in the size of the eye, therefore, can not be ascribed to age.

c. The ventral fins in *G. dentatus* are inserted notably nearer the tip of the snout than the base of the caudal. In *A. tittmanni* these fins are placed much nearer the base of the caudal than the end of the snout.

d. The arrangement of the photophores on the two types is very different. In *G. dentatus* they are in regular and continuous series and not in groups, as shown in the figure of *A. tittmanni*.

A white, ovoid light organ lying in a slitlike socket behind and below eye; a yellow, elongated suborbital organ lying within orbit at basal margin of eye; two rows of small photophores on each side of body ventrally, the upper row consisting of 6 linear groups from pectoral to ventral, 4, 3, 3, 3, 3, 4, then a group of 3 and 8 single, more or less equidistant, to vertical from origin of anal, where the row ends in a group of 4; ventral row with 6 clustered groups of 2 to 4 each from pectoral to ventral, then 5 linear groups of from 2 to 4 each to above origin of anal; a single row of 11 photophores over base of anal to end of caudal peduncle.

Dorsal origin very slightly behind that of anal, the bases of both fins elevated anteriorly; distance from tip of snout to origin of dorsal, 1.23; to anal, 1.27; to ventral, 1.70; caudal, 2.28 in head, its lower lobe the longer; ventrals, 1.71 in head, behind middle of body, the rays filamentous at tip; pectorals, 1.85 in head, filamentous.

Color in alcohol, head and body very dark sooty brown, almost black, finely sprinkled with minute white granulations; dorsal and anal black basally for about the first 8 or 9 rays; caudal unpigmented; ventral rays spotted with black; pectorals unpigmented; suborbital organ yellow; postorbital organ white; barbel white, with a series of minute black dots, bulb at tip of barbel yellowish.

Type.—Cat. No. 84290, U.S.N.M., 46 mm. long, taken with a townet at Station 10161 about 115 miles east from Cape Hatteras, at a depth of from 100 to 0 meters.

(*tittmanni*, named for Dr. O. H. Tittmann, former Superintendent of the United States Coast and Geodetic Survey, who authorized the use of the *Bache* for the South Atlantic expedition.)

Genus EUSTOMIAS Vaillant.

Eustomias VAILLANT, *Travailleur et Talisman*, 1888, p. 112.

EUSTOMIAS PROXIMUS, new species.

This species is very close to *E. obscurus* Vaillant, from which it differs in the larger number of dorsal and anal rays, the character of the ventrals and pectorals, and the color of the skin.

Six examples, as follows:

Station 10169 C, 270 miles southeast from Cape Hatteras, 50 to 0 meters, 2 examples, 83 and 80 mm.

Station 10180, 30 miles southwest from Bermuda (type)), 75 to 0 meters, 1 example, 132 mm.

Station 10186, 270 miles southwest from Bermuda, 85 to 0 meters, 1 example, 75 mm.

Station 10209, 40 miles north from Little Bahama Bank, 100 to 0 meters, 1 example, 98 mm.

Station 10211, 90 miles north from Great Abaco Island, 100 to 0 meters, 1 example, 101 mm.

Dorsal, 29; caudal, 19; anal, 43; ventral, 7; pectoral, 3.

Head 8.33 (8.80 in total length), compressed, its breadth 2.5 in its length, profile concave; body long, cylindrical, compressed posteriorly; greatest depth 18 (18.9 in total length); eye 5, lateral, circular; snout, 2.73, pointed; mouth large, lower jaw projecting; maxillary 1.15, extending 1⅔ eye diameters beyond vertical from posterior margin of eye; barbel long, filamentous, its shaft unpigmented, terminating in a dark-colored suboblong bulb, slightly constricted mesially, from the distal end of which arises a short stalk bearing six filaments; of these, one is about as long as the bulb, the others about one-third shorter; each filament bears at its tip a club-shaped, dark-colored bulb; teeth in both jaws in a single row, canine, recurved, of unequ length, the largest in the upper jaw being the first, second, third, and seventh, in the lower jaw the second, third, and sixth; tongue with three pairs of strong recurved teeth; vomer and palatines toothless; interorbital 3.75, concave; body scaleless.

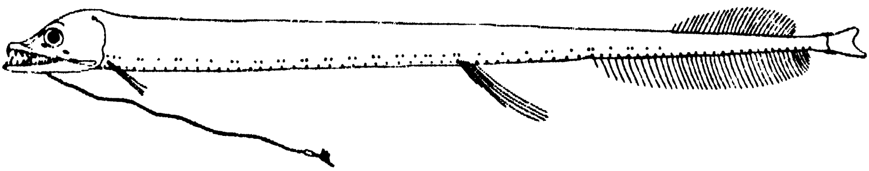

FIG. 3.—EUSTOMIAS PROXIMUS, NEW SPECIES.

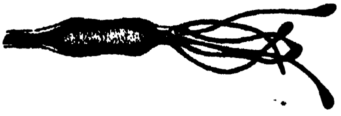

FIG. 4.—EUSTOMIAS PROXIMUS, TIP OF BARBEL.

A small elongated luminous area close to maxillary behind vertical from posterior margin of eye, a similar area beneath lower anterior margin of eye, and a minute one of similar shape in lower margin of eye; what appears to be a crescent-shaped luminous area on upper margin of eye; two rows of photophores on sides of body ventrally, the upper row spaced singly and in pairs as follows: Gill opening to ventrals, 1, 1, 1, 2, 1, 2, 1, 1, 2, 2, 2, 2, 2, 2, 2, 2, 1, 2, 1, 2, 20 groups; ventrals to anal, 1, 1, 1, 2, 1, 2, 6 groups; anal to end of series, 1, 2, 1, 1, 4 groups; lower row spaced singly, hyoid arch, 9; isthmus to pectoral, 7; pectoral to ventral, 33; ventral to anal, 11; anal to caudal, 26.

Dorsal origin over 13th anal ray, its termination over 38th anal ray; distance from tip of snout to origin of dorsal 1.22, to anal 1.39, to ventral 1.81, to pectoral 8.18; length of ventrals equal to that of head, the two outer rays short, but not standing in a detached group; pectorals 1.75 in head, the rays separate, each with a bladelike membrane extending to tip.

Color in alcohol, head and body dark metallic bronze, thickly covered with minute black punctulations; all fins unpigmented.

Type.—Cat. No. 84285, U.S.N.M., 132 mm. in length, taken with a townet at Station 10180, 30 miles southwest from Bermuda, at a depth of from 75 to 0 meters.

(*proximus*, near to *Eustomias obscurus*.)

EUSTOMIAS BIGELOWI, new species.

Dorsal, 22; caudal, 19; anal, 41; ventrals, 7; pectorals, 2.

Head 7.95 (8.50 in total length), compressed, its breadth equal to one-half its length; profile convex, two bony ridges extending from above posterior nostril to behind eye; body long, compressed posteriorly; greatest depth 12 (12.8 in total length); eye 4.80, lateral, circular; snout 3; mouth large, jaws equal; maxillary 1.17, extending about 2 eye diameters behind vertical from posterior margin of eye; barbel short, stout, 7.35 in length without caudal, club shaped, three filaments arising about midway in its length, a subconical organ at its tip, from which arise three long and four short filaments; teeth in both jaws in a single row, canine, of unequal length, their tips recurved, the largest in the upper jaw being the first, fourth, tenth, and fifteenth; tongue with three pairs of strong recurved fangs, vomer and palatines toothless; interobital 4, convex; body scaleless.

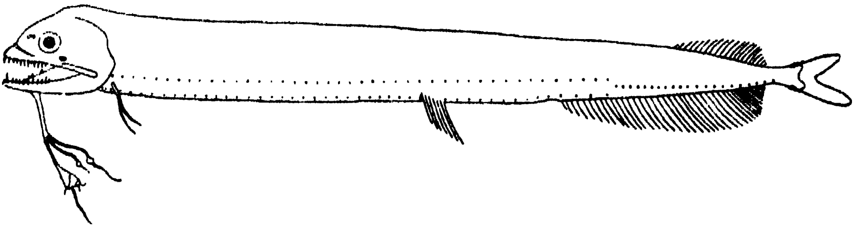

FIG. 5.—EUSTOMIAS BIGELOWI, NEW SPECIES.

A small triangular luminous area close to maxillary behind vertical from posterior margin of eye; two rows of small, circular, nearly equidistant photophores along side of body ventrally, extending to about the 6th anal ray; from this point to the caudal peduncle a single intermediate row of somewhat larger photophores; upper row, gill opening to ventrals, 29; ventrals to anal, 10; along anal, 4; lower row, isthmus to pectorals, 9; pectorals to ventrals, 29; ventrals to anal, 10; along anal, 4; intermediate row along anal to caudal peduncle, 21.

Dorsal origin over 15th anal ray; distance from tip of snout to origin of dorsal 1.15, to anal 1.33, to ventral 1.74, to pectoral 7.35; ventrals 1.6 in head, the rays not divided into two groups; pectorals 1.5 in head, the rays filamentous, closely united for a short distance at base.

Color in alcohol, body and head velvety black, with minute white granulations, these most abundant along lower row of photophores; barbel black, its conical tip and filaments white; dorsal and anal nearly colorless, their rays pigmented basally, the last 10 banded with black at segments; ventrals colorless, the rays evenly pigmented with black; pectorals black.

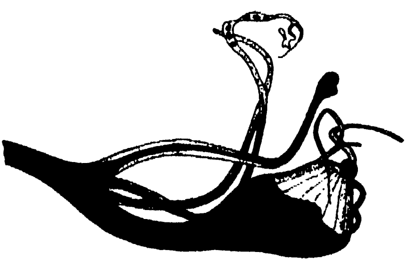

FIG. 6.—EUSTOMIAS BIGELOWI, TIP OF BARBEL.

Type.—Cat. No. 84284, U.S.N.M., 102 mm. long, taken with a townet at Station 10163½, 170 miles southeast from Cape Hatteras, at a depth of from 500 to 0 meters.

One other example, 88 mm. long, anal count 42, taken in a townet at Station 10162, 120 miles east-southeast from Cape Hatteras, at a depth of from 150 to 0 meters.

(*bigelowi*, named for Dr. H. B. Bigelow, of the Cambridge Museum of Comparative Zoology.)

EUSTOMIAS ENBARBATUS, new species.

This species approaches *E. obscurus* Vaillant and *E. proximus*, but differs from them in the number and arrangement of the photophores, in which it closely resembles *E. bigelowi*. From the latter it differs in the number of anal rays, the number and character of the pectoral rays, and the length and form of the barbel.[4]

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[4] The author has mentioned the close relationship of his species, *Eustomias enbarbatus*, and *E. obscurus* Vaillant, calling attention to the difference in the arrangement of the photophores. A comparison of the type of *E. enbarbatus* with the drawing and description of the type of *E. obscurus* has revealed a few other differences worthy of note for the convenience of the student.

a. The ventral fins in *E. obscurus* are divided into two parts, the upper division consisting of three short rays and the lower of four long rays. These fins are undivided in *E. enbarbatus*.

b. The head in *E. obscurus* is not notably elevated and the profile is little concave over the snout and only slightly convex from the head to the nape. In *E. enbarbatus*, as shown in the drawing, the head is much elevated, the profile is concave over the snout and strongly convex over the head

c. A very great difference is evident in the detail structure of the barbel. The bulbs at the end of these organs are different in shape and the tentacles attached thereto are also very different. For the structure of those of *E. enbarbatus* refer to figure 8. Those of *E. obscurus* are seven in number, all originating from the distal end of the large bulb, and each tentacle in turn ending in a small bulb.

Dorsal, 23; caudal, 19; anal, 35; ventrals, 7; pectorals, 3.

Head 7.1 (7.63 in total length), compressed, its profile oblique, its breadth equal to one-third its length; body long, compressed; greatest depth 12.8 (13.8 in total length); eye 5.12, lateral, circular; snout 3; mouth large, lower jaw projecting; maxillary 1.20, extending about 2 eye diameters beyond vertical from posterior margin of eye; barbel long, filamentous, an ovoid bulb at tip; near the base of this bulb arises a long filament containing at intervals yellowish ovoid bodies; from the distal portion of the bulb arise five short filaments, four of which are simple, two of them containing ovoid bodies; the fifth terminates in an ovoid body from which spring two longer filaments, tridentlike, both of which bifurcate; each of these latter contains in its proximal half several yellow bodies, the distal half being threadlike; teeth in both jaws in a single row, canine, of unequal length, their tips somewhat recurved, the largest in the upper jaw being the first, second, and fifth, in the lower jaw the second, fourth, and seventh; tongue with three pairs of long recurved teeth; vomer and palatines toothless; interorbital 4.5; body scaleless.

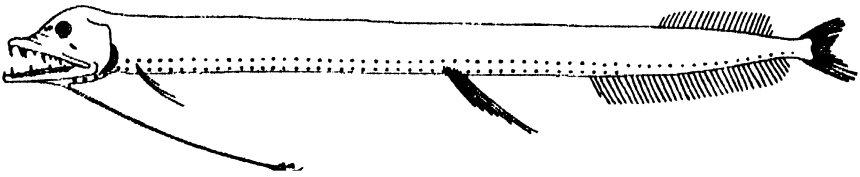

FIG. 7.—EUSTOMIAS ENBARBATUS, NEW SPECIES.

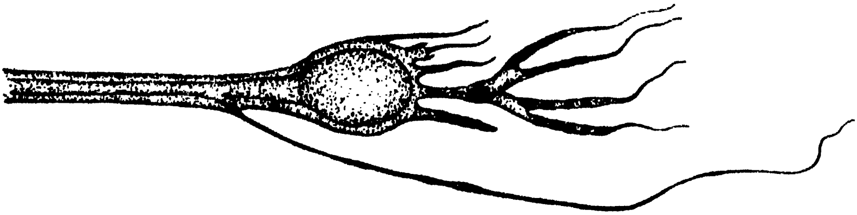

FIG. 8.—EUSTOMIAS ENBARBATUS, TIP OF BARBEL.

A small oval luminous area close to maxillary behind eye; two rows of small, circular, nearly equidistant photophores on sides of body ventrally, the upper row extending to end of anal, the lower to 5th anal ray, 27 in each row from pectorals to ventrals.

Dorsal origin over 13th ray of anal, its termimation over 32d ray; distance from tip of snout to origin of dorsal 1.14, to anal 1.33, to ventrals 1.68, to pectorals 5.81; ventrals 1.28 in head, the two outer rays short, but the rays not divided into two groups; pectorals 1.8 in head, the rays apparently filamentous, with a narrow membrane on both sides of each ray, not united at base.

Color in alcohol, body and head velvety black with minute white granulations, these most abundant along the lower line of photophores; barbel white, its core punctulated with black, bulb at tip and bodies in filaments yellow; vertical fins unpigmented, excepting the last few rays of anal and outer rays of caudal, which are banded with black at the segments basally; ventral and pectoral rays slightly pigmented with black.

Type.—Cat. No. 84282, U.S.N.M., 69 mm. long, taken with a townet at Station 10173, 185 miles west from Bermuda, at a depth of from 100 to 0 meters.

One other example, 60 mm. long, taken at Station 10192, 220 miles northeast from Great Abaco Island, at a depth of from 1,000 to 0 meters. This example has a barbel of the same type, but developed to a lesser degree.

(*enbarbatus*, calling attention to the remarkable barbel.)

Genus DACTYLOSTOMIAS Garman.

Dactylostomias GARMAN, Mem. Mus. Comp. Zool., 1899, p. 279.

DACTYLOSTOMIAS DIGITATUS, new species.

Close to *D. ater* A. Brauer, but differing therefrom in having a much larger eye, lower dorsal and anal counts, higher pectoral count, and the different character of the suborbital photophore. Only the type taken.

Station 10171, 255 miles west from Bermuda, 75 to 0 meters, 1 example, 35 mm.

Dorsal, 14; caudal, 19; anal, 15; ventrals, 9; pectorals, 3 to 4.

Head 5 (5.82 in total length), long, low, its width 2.40 in its length; body somewhat compressed; depth 10 (11.16 in total length); eye large, subovate, lateral, its length 4.28 in head, 1.42 in snout; snout acute, projecting; maxillary 1.13, extending about 1½ eye diameters beyond vertical from posterior margin of eye; barbel long, simple, filamentous; teeth in both jaws in a single row, canine, of unequal length, with recurved tips; first pair in upper jaw set high, protruding through skin of snout; second pair longest, three-fourths diameter of

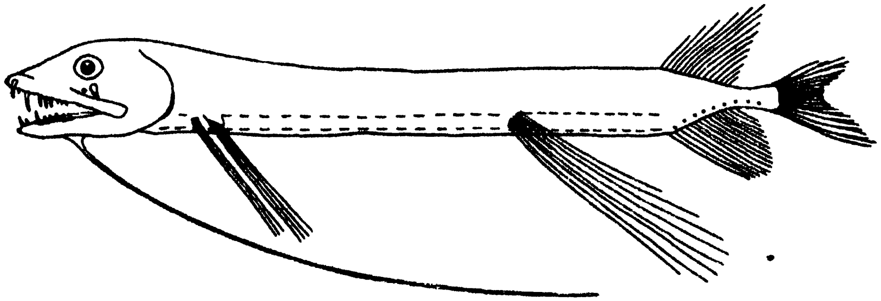

FIG. 9.—DACTYLOSTOMIAS DIGITATUS, NEW SPECIES.

eye; seven smaller pairs of canines followed by 16 small recumbent teeth; first pair in lower jaw small, exserted, divergent; second pair longest, followed by eight smaller pairs of canines; tongue with two groups of recurved teeth; four or five teeth on each palatine; vomer toothless; interorbital 3.75; body scaleless.

A large ovate luminous organ behind and below eye, a smaller one in advance of this on upper edge of maxillary; two rows of elongated photophores on sides of body ventrally, about 15 in upper row from pectorals to ventrals.

Dorsal origin over that of anal; distance from tip of snout to origin of dorsal 1.20, to ventral 1.87, caudal 1.20 in head, its lower lobe the longer; ventrals 3.75 in length without caudal, the rays hairlike; pectorals 5 in length without caudal, its rays filamentous, the first three closely united at base, a short interspace between these and the next four, which are separate and somewhat swollen at base.

Color in alcohol, head and body metallic bronze, thickly sprinkled with minute white grandular bodies with blackish margins; all fins unpigmented, except the swollen bases of the last four pectoral rays, which are black.

Type.—Cat. No. 84291, U.S.N.M.

(*digitatus*, fingered.)

Genus TRICHOSTOMIAS Zugmayer.

Trichostomias ZUGMAYER, Bull. Ocean. Inst. No. 193, 1911.

TRICHOSTOMIAS METALLICUS, new species.

This species is close to *T. vaillianti* Zugmayer, from which it differs chiefly in its much smaller eye, higher number of dorsal and anal rays, and the presence of four small teeth on the palatines.

Nine examples taken by the *Bache*, as follows:

Station 10161, 115 miles east from Cape Hatteras, 1,000 to 0 meters, 1 example, 40 mm.

Station 10166, 240 miles southeast from Cape Hatteras, 100 to 0 meters, 1 example, 42 mm.

Station 10169, 270 miles southeast from Cape Hatteras, 50 to 0 meters, 1 example, 40 mm.

Station 10169 C, 270 miles southwest from Cape Hatteras, 50 to 0 meters, 3 examples, 41 to 33 mm.

Station 10173, 185 miles west from Bermuda, 100 to 0 meters, 2 examples, 46 to 40 mm.

Station 10184, 210 miles south-southwest from Bermuda, 100 to 0 meters, 1 example, 45 mm.

Dorsal, 15; caudal, 24; anal, 16; ventrals, 5; pectorals, 2–1.

Head 4.80 (5.5 in total length), subconic, its width 2.08, its depth 1.82 in its length, smooth, without ridges; body cylindrical, slightly compressed posteriorly, greatest depth 8.75 (10 in total length); eye minute, circular, 14.6 in head; snout acute, projecting, 2.43; mouth large, lower jaw included; maxillary 1.04, extending about 8 eye diameters behind vertical from posterior margin of eye; barbel very long, filamentous, its base directly under eye (apparently incomplete in all the examples, in one of which it is 1¼ times length of body without caudal); teeth in both jaws in a single row, canine, of unequal length, the longer teeth in upper jaw projecting when mouth is closed; tongue with two groups of strong retrorse teeth; palatines with two small teeth each; vomer toothless; interorbital 2.65, convex; body scaleless.

An ovoid light organ close to maxillary behind vertical from posterior margin of eye, contiguous with which is an oblong organ on upper edge of maxillary; a row of indistinct glandular organs on sides of snout and cheeks; two rows of small, elongated photophores on sides ventrally, about 30 in each from gill opening to anal; a single row of somewhat larger photophores above anal, extending to end of caudal peduncle.

Dorsal origin three rays in advance of that of anal; distance from tip of snout to origin of dorsal 1.16, to ventral 1.89, caudal 1.46 in head, its lower lobe much the longer; ventrals 2.80, the rays hairlike, separate throughout their length; pectorals 3.50, the first two rays slender, united at base, filamentous, the third ray stouter, bristlelike, its base an eye diameter behind that of the other two, all three rays of about equal length.

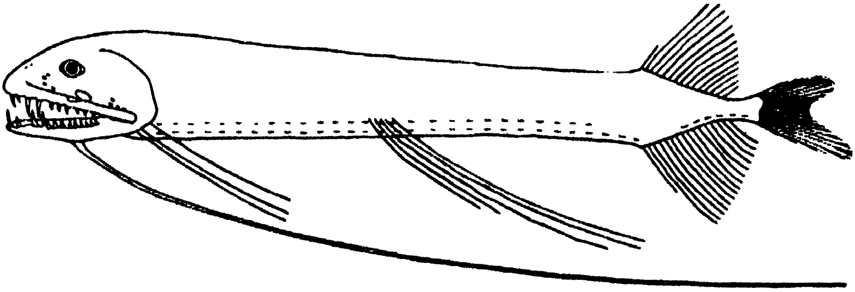

FIG. 10.—TRICHOSTOMIAS METALLICUS, NEW SPECIES.

Color in alcohol, head and body dark greenish bronze with bright metallic reflections, thickly strewn with minute white dots bordered with black pigment; top of head, margin of opercular flap, and photophores, black; all fins unpigmented, barbel white, speckled with minute black chromatophores.

Type.—Cat. No. 84294, U.S.N.M., 40 mm. long, taken in a townet at Station 10169, 270 miles from Cape Hatteras, at a depth of from 50 to 0 meters.

(*metallicus*, metallic).

A REVISION OF THE NORTH AMERICAN TWO-WINGED FLIES OF THE FAMILY THEREVIDAE.

By Frank R. Cole,
Of Stanford University, California.

INTRODUCTION.

This study of the Therevidae was a part of some graduate work done at Stanford University, beginning in the autumn of 1919. While at Washington, District of Columbia, a few years ago the writer made some notes on the types in the United States National Museum collection and named a personal collection of Therevidae by comparison. It is to be regretted that no further reference to types (with a few exceptions) has been possible during the preparation of this paper. But most of the species are so well marked as to be easily identified from the descriptions, and authentically determined material from other dipterists has aided considerably. Possibly a few mistakes have been made due to not having seen all type material, but as there was no opportunity of doing this in the near future it seemed best to publish the results of this study at this time, rather than wait a number of years and delay progress on the work done in this family of diptera.

Of the 82 previously described species the writer has examined 50 during the progress of the work, 3 of this number being types. The 32 species not available for study are largely uniques, and the types of a number are in Europe. The types of 9 of these rare species are in the United States National Museum, and the writer made notes on some of them when studying that material some years ago. Nine of the 32 species not examined are Mexican, but they may be taken in States along the border by future collectors. The writer collected 22 species in addition to new forms, 15 of these in the type localities. Over 1,200 specimens were examined from various parts of North America, a collection extensive enough to give some idea of the species occurring in this region.

The location of the types of new species is designated under the specific descriptions. The type material belonging to the writer has been placed in the United States National Museum, which also contains by original deposit or subsequent purchase nearly all of Kröber's types. The names of the collectors are given in parentheses and the location of the material in brackets. In the listing of specimens abbreviations are used for the names of institutions which have furnished material: M. C. Z. = Museum of Comparative Zoology, Cambridge, Massachusetts; A. N. S. P. = Academy of Natural Sciences of Philadelphia; Canad. coll. = National Canadian collection at Ottawa; Harrisb. coll. = Department of Agriculture, Harrisburg, Pennsylvania; Amer. Mus. = American Museum of Natural History, New York City; B. S. N. H. = Boston Society of Natural History.

The writer greatly appreciates the generous loan of material during the study of the Therevidae and wishes to thank the following entomologists for their assistance: Mr. W. L. McAtee, United States Biological Survey; Mr. E. P. Van Duzee, California Academy of Sciences; Mr. M. C. Van Duzee, Buffalo, New York; Mr. Nathan Banks, Museum of Comparative Zoology in Cambridge, Massachusetts; Dr. O. A. Johannsen and Prof. M. D. Leonard, Cornell University; Mr. H. Kahl, Carnegie Museum; Mr. R. S. Sherman, Vancouver, British Columbia; Dr. C. P. Alexander, Illinois Laboratory of Natural History; Mr. E. T. Cresson, jr., Philadelphia Academy of Natural Sciences; Mr. H. H. Knight, University of Minnesota; Prof. R. A. Cooley, University of Montana; Mr. C. H. Curran, Orillia, Ontario, Canada; Prof. J. S. Hine, Ohio State University; Dr. S. J. Hunter, Kansas University; Dr. J. McDunnough, in charge Canadian collection of insects at Ottawa; Dr. F. E. Lutz, American Museum of Natural History, New York City; Mr. A. B. Champlain, department of agriculture, Harrisburg, Pennsylvania; Dr. J. M. Aldrich, United States National Museum; and Mr. M. C. Lane, United States Bureau of Entomology. The writer is especially indebted to Mr. C. W. Johnson for the loan of material from his personal collection and from the collection of the Boston Society of Natural History and also for notes on various species. To Prof. R. W. Doane, of the department of entomology at Stanford University, thanks are due for many helpful suggestions during the course of the work and for aid in the final preparation of the paper for publication. Maj. E. E. Austin has kindly examined the types of Walker's species in the British Museum, and the writer is indebted to him for notes on these specimens and for comparison of specimens of *Thereva vialis* with the closely allied *Thereva annulata* Fabricius of Europe.

HISTORY OF CLASSIFICATION OF FAMILY.

In the year 1796 Latreille established the genus *Thereva*.[1] The flies of this genus were, previous to this, placed in the old genus *Bibio* of Fabricius and *Musca* Linnaeus. In 1838 Zetterstedt founded the genus *Psilocephala* and about two years later Macquart and Wiedemann described a number of species in the family. In 1874

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[1] Précis des Caractères génériques des Insectes, etc.

Loew published on the Therevidae of Europe and made some interesting observations on the genus *Thereva.*

Osten Sacken's Catalogue of the North American Diptera, published in 1878, listed 4 genera and 43 species in the family, counting Walker's 6 species, which were listed in a footnote, with the observation that most of them would coincide with Say's or Loew's species, the others being unrecognizable from the descriptions. Four of the specific names used in this catalogue have been relegated to synonymy and two are described from Cuba and are not included in the list later given by Aldrich.

In 1893 Coquillett wrote a synopsis of the genera *Thereva* and *Psilocephala* and in 1894 a short revision of the family. He described a large number of species but made no extensive study of the family. In 1912 Kröber published his Revision of the Therevidae of North America, and, having a good general knowledge of the group, his paper was a valuable contribution to the knowledge of the family. The work is incomplete, due in part to the lack of material for study, and many species are included in the tables from reading the descriptions. Some of the new species are based on one or two specimens, often only one sex being described, and as no figures are given there may be some difficulty in separating the species from closely allied forms, even though the descriptions are usually quite complete. Kröber had a tendency to "lump" species that were superficially alike, judging from the material in the collection of the United States National Museum that was sent to him for determination. Under *Psilocephala haemorrhoidalis* there were found no less than seven distinct species, all allied to *haemorrhoidalis*, but clearly different when carefully examined. Kröber's work on the Therevidae of the world, published as one of the parts of the Genera Insectorum in 1913, is of great assistance to students of the group; in this monograph he recognizes 442 species, grouped in 38 genera.[3]

Aldrich (1905), in his Catalogue of North American Diptera, gives 6 genera and 71 species in the Therevidae. In his revision of the North American species Kröber lists 9 genera and 81 species. The writer has erected 4 new genera and has described 38 new species in the following pages, making a total of 13 genera and 118 species, and there is little doubt that many more species will be added during the next few years.

STRUCTURAL CHARACTERS.

In general appearance the Therevidae are somewhat like the more weakly bristled robber flies which are placed in the subfamily Dasypogoninae, but they are, as a rule, less heavily built, have weaker legs, fewer bristles, and a differently shaped head; the eyes never bulge out conspicuously from the vertex and are usually contiguous in the males. The venation easily distinguishes the Therevidae from the Bombyliidae and the Apioceridae, the latter differing also in the form of the palpi. Most of the species are small or moderate in size, but usually over 5 mm. in length. The antennae are three-jointed and the radius is furcate; thus they belong to the first group of the Orthorrhapha Brachycera, the Tromoptera, or fourth superfamily. The abdomen is usually more or less conical, the general color gray or brown, and in many species densely covered with pile. The males are usually more pilose than the females, and in some species they are silvery pollinose. There are no North American species with a metallic coloration.

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[3] After completing this manuscript the writer obtained a copy of Kröber's paper (Beiheft zum Jahrbuch der Hamburgischen Wissenschaftlichen Anstalten) published in 1914. Critical remarks and diagnoses of species have been added in the galley proof. One new genus and fifteen new species are described from North America.

The head is usually hemispherical, the occiput distinct, the eyes large and in most genera the males have the facets on the upper portion noticeably larger, often with a more or less distinct line of division between the small and large facets. The eyes are bare and usually holoptic, or nearly so, in the male. In a few genera the eyes are separated in the male by the width of the ocelli, as in the foreign genera *Neothereva*, *Platycarenum*, and *Ectinorrhynchus*, and the American genera *Tabuda*, *Metaphragma*, *Henicomyia*, and *Nebritus*. One species of *Psilocephala* described in this paper, *latifrons*, has the eyes thus widely separated, and might be placed by some dipterists in a new genus. The eyes of the female are always widely separated. Some species have the eyes colored or marked with a purple crossband. There are three ocelli on the small ocellar tubercle. Most of the species have distinct orbital or post-ocular bristles.

The writer has not followed Peterson in naming some of the sclerites of the head. The term "vertex" as used by Peterson applies to the space between the eyes from the top of the head to the cheeks. It has been the custom of dipterists to limit the term "vertex" to the region of the occelli, the part from the vertex to the base of the antennae being called the front or frons, that from the base of the antennae to the genae the face. The frons in the Therevidae is usually flat or slightly convex, never excavated as in the Asilidae, and may be wholly pollinose, shining, or marked with characteristic spots and lines. The face is short and often receding and may be bare or pilose. The cheeks are usually quite narrow.

The antennae are porrect, of medium or large size, situated in the middle of the head in profile, or a little below the middle, and are often on a protuberance; they are usually close together at the base. In most species the first antennal joint is cylindrical and rather long, but often greatly swollen; in *Euphycus* it is longer than the head. The second joint is shortest and usually rounded and with very short bristles. The third joint is quite varied, in some short and broad, usually as long as the first, in *Henicomyia* five times as long; in *Ozodiceromyia* it appears ringed and spinose. In the genus *Dialineura* and in certain species of *Psilocephala* the third joint is quite short, often with a more or less distinct basal annulation. The antennal style or arista is usually two-jointed and is more or less variable in shape, usually apical, but in some cases subapical or dorsal. In the genus *Henicomyia* there is apparently no style present. Coquillett and Kröber both overlooked the fact that there is a distinct style on the third antennal joint of *Nebritus* (a genus with one species); the style is not at the extreme apex of the third joint, but in a shallow dorsal pit a short distance from the tip. In the new genus *Epomyia* there is an approach to this form of antenna.

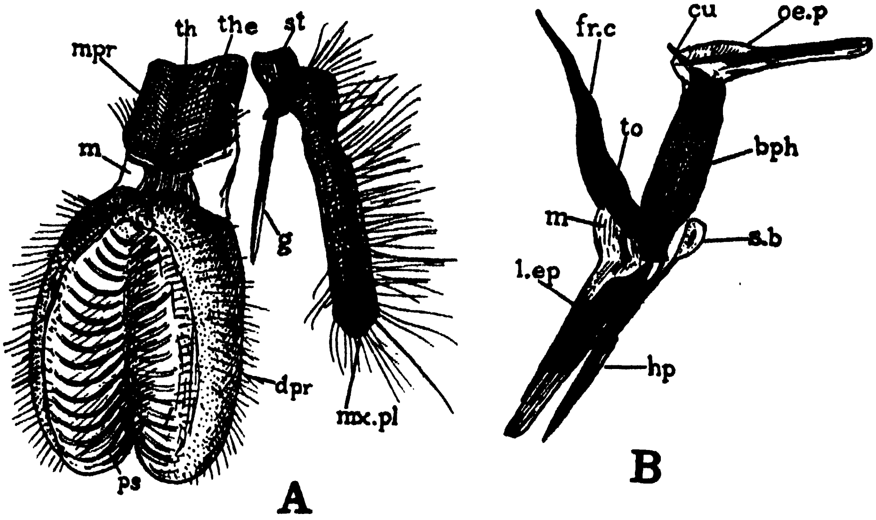

Fig. 1.—Mouth parts of Dialineura crassicornis Williston. *A*. Outer mouth parts (distiproboscis and mediproboscis, with palpi and galea). *B*. Inner mouth parts (hypopharynx, epipharynx, basipharynx, oesophagal pump, etc.). *m*, membrane; *mpr*, mediproboscis; *th*, thickening; *the*, theca; *ps*, pseudotrachea; *dpr*, distiproboscis; *g*, galea; *st*, stipes; *mx. pl.*, maxillary palpus; *fr. c.*, fronto-clypeus; *cu*, cornu; *oe. p*, esophagal pump; *to*, torma; *bph*, basipharynx; *s. b.*, salivary bulb; *l. ep*, labrum epipharynx; *hp*, hypopharynx.

The mouth opening is comparatively small and the proboscis and palpi small as a rule, but in *Psilocephala* the mouth parts are rather large. The mouth parts consist of the usually broad, fleshy, bilobed distiproboscis (see fig. 1*A*), which is grooved on the underside. Above this is a narrow chitinized connection surrounded by a membrane and the mediproboscis with a median thickening. The well developed, one-jointed maxillary palpi are connected with the proboscis, being fastened to the stipites, which in turn are fastened to the mediproboscis. The galea, not present in some families of the diptera, is narrow and needlelike. The mouth structure facing the buccal cavity (see fig. 1*B*) consists of the hypopharynx, the epipharynx, a membraneous area in posterior continuation of and rising above the epipharynx, and a small salivary bulb behind and fastened to the hypopharynx. Almost at right angles to the hypopharynx is the frontoclypeus, and leading back to the esophagal pump is the heavily chitinized basipharynx. At the top of the basipharynx on each side is a small appendage called the cornu. In none of the North American genera do we find the proboscis noticeably protruding (the foreign *Acupalpa* has needlelike mouthparts). The palpi are longer haired in *Psilocephala* than in most of the other genera and in *Henicomyia* are very peculiar in shape.

The thorax is of moderate size, the dorsum long oval and with hairs and bristles; the bristles are quite uniform in general arrangement, but are apparently of no systematic importance, owing to the variation being mostly individual and not specific. There are from two to six praesutural, usually two supraalar, one postalar and one or two pairs of praescutellar bristles. In the new genus *Caenotus* there are no distinct thoracic bristles. The mesonotum is usually more or less pollinose and often with longitudinal vittae; in the males the mesonotum is usually densely pilose, but in some forms almost bare in both sexes. The scutellum is medium sized and usually semicircular, with two to four apical bristles; it is like the thorax in color as a rule. The squamae are small and the halteres are quite large; in *Furcifera* the squamae are hairy.

The abdomen varies somewhat in general form, but is usually conical, especially in the male; in some of the foreign genera the abdomen is more or less modified in shape. The males of some genera have a silvery shimmer to the pollen on the tergites and the females often have silvery spots or bands. The abdomen in the male is usually much more pilose than in the female. As in many of the Asilidae, the female has a terminal circlet of spines on the last segment; this is lacking in the new genus *Pherocera* and in the foreign *Oldenbergia*. The male hypopygium is not very large in the majority of species and the genitalia have not been made use of in the past in the classification of the group, but they possess specific differences which are of great importance. The typical genitalia are shown in text figures 2 and 3. Crampton in a recent article[3] has worked out the homology of the genitalia of several orders of insects, including the diptera, and the writer has followed this interpretation of the different parts. In the Therevidae there are two plates forming the hypandrium, which is usually smaller than the upper covering of the genitalia; this upper portion is composed of the ninth and tenth segments combined and is called the epiproct. The general form of the genitalia is alike in all the North American genera.

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[3] Psyche, vol. 27, pp. 34 to 44.

In all the species the proctiger is a separate plate, considered an eleventh segment by some morphologists, and has two narrow flaps above; these flaps are in some cases quite conspicuous. There is some variation in the form of the aedeagus and good specific characters may be found in this portion of the genitalia and in the gonopods (styles and lobes) attached to the hypandrium. These characters have been used very little in this paper, but ultimately

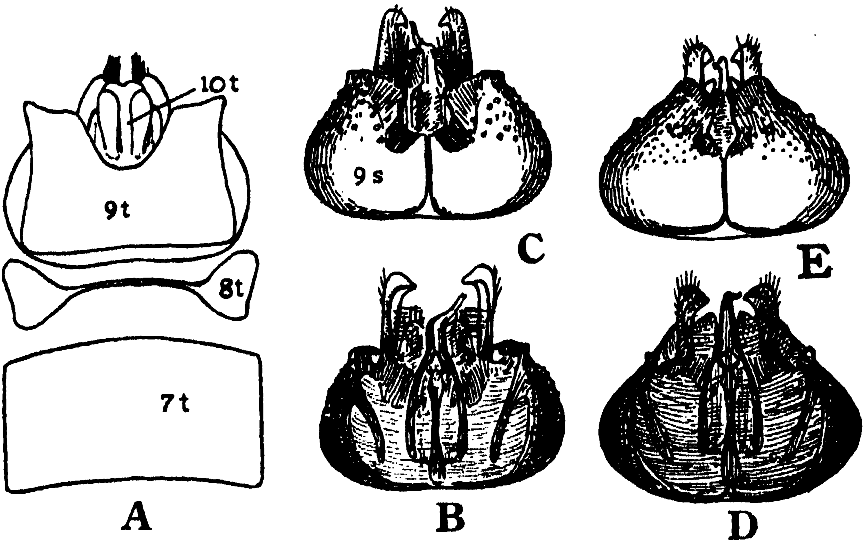

FIG. 2.—MALE GENITALIA. *A*. DORSAL VIEW OF APEX OF ABDOMEN OF PSILOCEPHALA FRONTALIS. *B*. INTERNAL GENITAL ORGANS OF SAME. *C*. NINTH STERNITE OF P. FRONTILIS. *D*. INTERNAL GENITAL ORGANS OF PSILOCEPHALA HAEMORRHOIDALIS. *E*. NINTH STERNITE OF P. HAEMORRHOIDALIS.

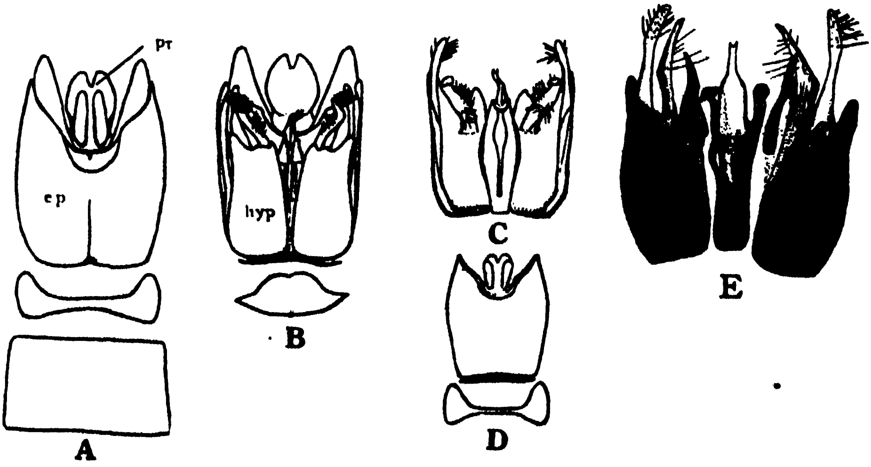

FIG. 3.—MALE GENITALIA. *A*. APICAL SEGMENTS OF DIALINEURA CRASSICORNIS. *B*. VENTRAL VIEW OF SAME. *C*. INTERNAL GENITAL ORGANS OF D. CRASSICORNIS. *D*. DORSAL VIEW OF MALE GENITALIA OF THEREVA VIALIS. *E*. INTERNAL GENITALIA OF SAME, HIGHER MAGNIFICATION.

they will be used more in the classification of the species, as they have been used in other groups of the diptera.

The legs of most of the species are long and not very heavy, the hind legs longer than the others. The anterior coxae have two (or more) bristles in front near the tip, the hind coxae have one bristle outside near the middle and two similar or smaller ones in front near the tip. The femora may be bare or with one or several bristles; the hind femora usually have a row of anteroventral bristles. There is often long pile on the femora, especially in the male. The front tibiae usually have two or three rows of small bristles, the hind tibiae often as many as four rows, and there are about six bristles in the circlet at the apex of the tibiae. As a rule the tarsi are slender, with short apical spines, the posterior tarsi with short plantar bristles on the basal joint. There are two small pulvilli (absent in the foreign *Caenophanomyia*). The empodia are wanting, or represented by a bristle, thus distinguishing the species from the Rhagionidae. The arrangement of the bristles on the legs is not very constant but may, when studied carefully, furnish specific characters.

There is a remarkable uniformity in the wing venation, the general plan being the same throughout the family, the new genus *Caenotus* showing the greatest departure from the normal type. In this paper the Comstock system will be used in place of the older Schinerian system, and the modification of it used by Williston and adopted by most of the dipterists in this country. In the Therevidae, R–4 and R–5 fork some distance from the end of the wing and the upper fork is noticeably curved in some of the genera, including *Psilocephala* and *Thereva*. The vein R–5 always ends in the wing margin, except in *Xestomyza*, where the lower fork drops down to the vein M–1. In *Metaphragma* there is a spurious cross vein connecting R–5 and M–1 beyond the furcation of Rs. The cell M–3 is open or closed, there being a certain amount of individual variation here, but the character usually holds for the species. The cell first A (anal cell) is always long and closed near or in the margin; cell R is longer than second M. Although the genera *Henicomyia* and *Nebritus* are quite aberrant in some respects they have a normal venation. In the genus *Pherocera* M–2 does not reach the wing margin and Cu–1 and M–3 coalesce far before the wing margin and stop short of it; in some specimens M–2 reaches the wing margin and in some it does not; also there seems to be a tendency for M–2 to branch near M–1 and for an extra cross vein to form. Abnormalities of venation are not infrequent. There is in many species a semicircular cloud at the outer side of cell first M–2 (discal cell), called a "Bogenwisch" by Kröber; an apical spot is also present in some, the cross veins are clouded in many, and there may be spots and bands on the wing, or a general infuscation. *Metaphragma* is the only genus having a supernumerary cross vein between

R-5 and M-1 (in the first posterior cell). There is usually a well-developed stigma, often quite thick and very prominent when the wing is hyaline. In the new genus *Caenotus* there is a great coalescence of veins; in *C. minutus* there is no m-cu cross vein or cell M-3 and Cu merges with M-3 in one vein, forming the bottom of cell first M-2 (discal cell); thus there are four veins from the cell. In the Therevidae only the alar pair of squamae are more or less developed, and these are folded so as to give the appearance of two pairs.

HABITS OF THE ADULT THEREVIDAE.

The habits of the adults are not well known. Some of the species have been reported as predaceous. Many years ago Schiner spoke of the adults as "robber flies" which have a somewhat cunning and uneasy catlike demeanor, lurking between the leaves of low shrubs and being able to conceal themselves quickly. Verrall never observed them preying on other insects in England, and Professor Poulton was not able to obtain any records for his paper on the predatory diptera. The writer has observed several species carefully and has never seen them catch other insects. Williston stated that the adults fed on small diptera, lying in wait for them on the ground or upon the leaves of trees and bushes. If they are predators they are feebly organized for such a mode of life. They are usually less active than the Asilidae, this being especially true of the females, and the proboscis has a fleshy labella which would make it impossible for them to kill any of the larger or more heavily chitinized insects. As a rule one does not have to watch a predaceous insect very long before seeing some evidence of its habits.

The imagines have been reported in large numbers around certain plants and many species are said to seek certain blossoms, the flowers of *Rubus* and *Crataegus* furnishing good collecting in parts of England. The writer has taken species of *Psilocephala* and *Thereva* while sweeping alfalfa plants during the summer months and large numbers of a new species of *Psilocephala* were taken about strawberry plants in June, in the Hood River Valley of Oregon.

The flight of some species of Therevidae is quite quick, but for only short distances and in some species hoplike. *Thereva pygmaea* is very quick on the wing. Undoubtedly the weather has a great deal to do with the activity of the flies, and specimens taken toward evening are apt to be slow in their movements, but the imagines of *Metaphragma planiceps* appeared to be sluggish when observed about midday. Some species taken along stream banks appear to keep rather close to the water, crawling about among grass stems, over drift trash, or sunning themselves on rocks and patches of sand. Many species are found not far from running streams, but others occur in arid regions and on sand dunes where there is little or no vegetation.

The writer had the opportunity of observing the imagines of *Dialineura crassicornis* in the Hood River Valley of Oregon and in the vicinity of Stanford University, California. This species is found on rocks and sand along stream beds where the country is open and sunny. In the vicinity of Stanford the adult flies were first noticed on April 27 in 1920, all the specimens observed on that date being males; these males were very alert and would not allow a near approach until they became accustomed to one's presence. They would stand on the rocks and sand with the front legs almost straight, the front end of the body thus being tipped up. Now and then one would fly up suddenly some 5 or 10 feet in the air and two or three others would start in pursuit. They were evidently awaiting the appearance of a female and would fly up after small pebbles tossed in the air near them, reaching the pebble before it started to fall and pursuing it to the ground in many instances. They would continue this game as long as one cared to throw for them and seemed to catch sight of the object some 10 feet away. Perhaps the larger facets on the upper part of the eye of the male permit an unusual vision. On a near approach to the object thrown in the air the flies would sense their mistake and return to the ground. None of them were seen feeding on other insects. The females were observed about a week later than the males and were much less active, none of them paying any attention to objects thrown near them, or to other insects flying over, as in the case of the males. Most specimens kept in captivity lived only two or three days, but two females, fed on sugar water, lived about eight days.

Adults of *Thereva vialis* were observed in the same localities with *D. crassicornis* and their habits were much the same. They appeared to emerge a little later and had a longer season. They lived no longer in captivity than the other species and no eggs were obtained from either.

EARLY STAGES OF THE THEREVIDAE.

Very little is known of the early stages of these flies or their habits, nothing being known of the egg stages. Zetterstedt, in a paper published many years ago, recorded one species of *Thereva* ovipositing in sand. The older larvae of several species are known and have been found to have various habits. They have been found in earth and decaying wood, feeding upon decaying vegetable or animal matter. Some specimens have been found singly under moss, fir needles, cow dung, fungus, decaying wood, especially alder branches. The larvae are predaceous and even cannibalistic. Westwood found *Thereva* larvae in pupae of *Aleucis pictaria* and *Sphinx ligastri* and the larvae of *Psilocephala eximia* in *Noctua*. Bergenstamm found the larvae in decaying oak wood in which the larvae of *Adelocera* lived.

Collinge has described the early stages of *Thereva nobilitata* from England[4] and expresses the opinion that all of the species have more or less economic importance in the larval state. The larvae move like an eel or snake, not being able to draw themselves together as most other dipterous larva do. Collinge noted that the larvae preferred compact but sandy soils, making use of earthworm burrows when in wet soil and forming small side chambers along them. He found larvae at the roots of currant trees and some at the roots of pinks and violets. These larvae were fed on the larvae of *Ceutorrhynchus sulcicollis*, also on fly larvae and small earthworms. The pupae were found on the surface of the soil or only partially covered by it.

Hyslop described the larva and pupa of *Thereva egressa* Coquillett and the feeding habits[5] from observations taken at Pullman, Washington. The larva was found in a wheat field in May, and when taken it had its head and first four anterior segments inside of an elaterid larva and was feeding on the viscera. The larva was fed on one or two elaterid larvae every day until June 10, when it pupated. From the description the larva is the typical of the family. The length at first was 25 mm. and 30 mm. just before pupating, with the thoracic segments much swollen. The pupa is evidently much like some of those in the genus *Psilocephala*, the length being given as 15 mm. The pupal stage in this case lasted 14 days.

Hyslop also reared *Psilocephala aldrichi* Coquillett and *P. munda* Coquillett from larvae taken in the field, associated with elaterid larvae and probably predaceous on them.

DESCRIPTIONS OF THE LARVAE AND PUPAE.

The larvae of the Therevidae are quite long and slender, cylindrical, chitinized, tapering at the two ends; the head small, heavily chitinized, and darker in color than the rest of the body; the mandibles well developed and pointed apically; antennae quite small. The prothoracic spiracle is distinct and there is a bristlelike hair on the side of each thoracic segment near the middle. The abdominal segments 1 to 6 are divided by constrictions so that there appear to be 20 segments in all. The anterior spiracles are on the segment behind the head, the posterior spiracles on the antepenultimate segment; the last segment ends in two short fingerlike processes.

The pupae are distinguished from those of the Asilidae by the presence of two horns (antennal sheaths) on the head, pointing outward, and a tubercle with a curved spine near the base of each wing

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[4] Journ. Econ. Biol., vol. 4, pp. 14-19.

[5] Proc. Ent. Soc. Wash., vol. 12, p. 98, 1910.

sheath. The thorax is rather heavy. Each abdominal segment has a circlet of bristles or thorns which are directed backward; the spiracles are situated on the proturberances along the anterolateral line and there are spines around them; the apical segment ends in two long slender thorns which are touching at the base, or in what might be termed a bifid spine.

The writer had the opportunity of examining the early stages of *Psilocephala frontalis*, new species, *P. haemorrhoidalis* Macquart, *P. argentifrons*, new species, and *P. limata* Coquillett. Descriptions of these are given following the account of the adults and they are illustrated on the plate 13.

GEOGRAPHICAL DISTRIBUTION.

Counting the species described in the present paper, there are 496 species and 43 genera in the Therevidae. Only *Thereva* and *Psilocephala* are spread over practically all countries, the other genera having a more or less limited distribution. Kröber lists 9 genera as Palearctic only, 11 as Indo-Australian only, 4 as North American only, 2 peculiar to Africa, and 1 to South America. To the peculiarly North American genera must be added the new genera described in the following pages: *Caenotus*, *Chromolepida*, and *Pherocera*. As in other groups, we find the simultaneous appearance of the same or allied genera in Australia, South America, and South Africa.

No European species are known from North America at the present time; the European species *Thereva annulata* Fabricius is very close to *Thereva vialis* Osten Sacken, the male being scarcely distinguishable, but Maj. E. E. Austin has kindly compared the two species and has found the females to be quite distinct, although closely allied. We know scarcely anything of the Mexican species or of those from Central America; Bellardi and Bigot described a few species and later Osten Sacken and Williston, but their material was very meager.

Most of the Therevidae do not penetrate far into northern latitudes, as they are flies that prefer bright sunshine, but a few species go north into Canada and some appear to be truly Boreal in their distribution. Some species of *Psilocephala* have a rather wide distribution in this country, but most are local and only a few Boreal species are known to occur clear across the continent. *Psilocephala aldrichi* has been recorded from the east to the west coast, but the eastern and western forms are quite distinct species. *Thereva brunnea*, new species, *T. senex*, *T. albifrons*, and *T. frontalis* are Boreal species and *Psilocephala munda* appears to be confined to northern latitudes or to high altitudes and occurs from the east to the west coast, as does *Thereva frontalis*. *Psilocephala haemorrhoidalis* and *P. frontalis*, new species, are two common eastern species which are so nearly alike that they have been confused; the latter species is described in the present paper and has spread farther west and north than *haemorrhoidalis*, all the Canadian specimens examined belonging to this species.

The genus *Henicomyia* is undoubtedly Mexican in its origin; probably the same is true of the new genera *Caenotus* and *Pherocera* and the genera *Euphycus*, *Ozodiceromyia*, and *Furcifera*. The genus *Chromolepida* is known from two species, one occurring in Nicaragua and the other in central California; the two species are very nearly alike and the Central American form was described by Coquillett as a species of *Psilocephala*. *Metaphragma* is represented by one species which occurs all along the Pacific coast and the one known species of *Nebritus* is reported only from California.

GEOLOGICAL DISTRIBUTION.

Several species of Therevidae have been described from fossil remains in Europe, three species having been described from Baltic amber by Loew. The specimens described have been assigned to the lower Oligocene, upper Oligocene, and upper Miocene. Scudder[6] mentioned a series of specimens taken at Florissant, Colorado, but did not describe any of the species. They were taken together with a number of Asilidae and many of the specimens were in good condition.

In 1909 Cockerell described two species from the Miocene shales of Florissant, *Psilocephala scudderi* and *P. hypogaea*, which are referred to in the bibliography. Both species seem to be quite closely allied to modern species of the genus *Psilocephala*. In the Proceedings of the United States National Museum (vol. 57, p. 251, 1920) Cockerell describes a new genus and species, *Eothereva simplex*, from Eocene rocks. This fly is described as similar to *Thereva*, but with very long antennae, the second joint longer than the other two together, and the third longitudinal vein of the wing simple. The discal cell is described as small and narrow, the anterior cross vein equally distant from its base and apex, the anal cell probably open, perhaps widely so. The species is 6 mm. in length, of which 3.4 mm. is abdomen; the wings about 5.5 mm. and reddish hyaline. The body as preserved is described as pale reddish.

TABLE OF GENERA.[7]

1. Thorax and abdomen largely clothed with scales, many of which are iridescent; face below the antennae with two shining callosities; antennae long, slender, short bristled, and with a small subapical style.... **Chromolepida**, new genus.
   Body with a tomentumlike pile, but never with scales; face without shining tubercles; third antennal joint with a style (except in *Henicomyia*)....... 2.
2. First antennal joint longer than the head and well developed............. 3.
   First antennal joint at most as long as the head, usually much shorter..... 4.

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[6] Bull. U. S. Geol. Surv. Terr., vol. 6, p. 291, 1881.

[7] The genus *Apsilocephala* described in Kröber's 1914 paper is near *Pherocera*, but has very slender wings and no stigma.

3. Third antennal joint long and appearing annulated, the labrum narrow. **Ozodiceromyia** Bigot.
   Third antennal joint not thus, first and second antennal joints with many bristles .... **Euphycus** Kröber.
4. Small species almost devoid of bristles; vein Cu-1 coalescing with M-3; antennae very short .... **Caenotus**, new genus.
   Larger species with distinct thoracic and scutellar bristles; venation normal, at least all the cells present .... 5.
5. Upper face hairy; more or less heavily built species, usually gray or brown pollinose, the males thickly pilose .... 6.
   Upper face bare; usually more slender, less pollinose and pilose species .... 7.
6. Wing with a cross vein connecting R-5 and M-1 outside the r-m cross vein; first antennal joint large and long bristled; eyes of males separated. **Metaphragma** Coquillett.
   Wing venation normal, the first antennal joint not large and swollen; eyes of males contiguous .... **Thereva** Zetterstedt.
7. Third antennal joint two and one-half to four times as long as first; slender species, the males dichoptic .... **Henicomyia** Coquillett.
   Third antennal joint at most two times as long as first; abdomen not very slender and more pilose .... 8.
8. Face projecting; first antennal joint large and shining, the style small and in a lateral pit some distance from the apex of the third joint. **Nebritus** Coquillett.
   Face not nearly horizontal; first antennal joint pollinose .... 9.
9. Eyes of male widely separated; first antennal joint about two times as long as the third, swollen, hairy; lower frons with considerable pile. **Tabuda** Walker.
   Eyes of male contiguous or nearly so (except in *Psilocephala latifrons*, new species); lower frons nearly bare of pile .... 10.
10. First antennal joint as large as in *Tabuda*, the third joint more slender; male abdomen with silvery white pile, the genitalia pollinose. **Dialineura** Rondoni.
   First antennal joint proportionately smaller; male genitalia usually shining; mostly slender species .... 11.
11. Antennae on a prominent convexity, the style as long as third joint and composed of two almost equal joints and an apical bristle; female genitalia flattened, more or less pointed, with an upper and lower plate and no circlet of bristles; vein Cu-1 and M-3 coalesce and do not reach the wing margin. **Pherocera**, new genus.
   Antennae with a much shorter style, usually only one joint visible; veins Cu-1 and M-3 if coalescing reach the margin of the wing; female genitalia rounded and with a terminal circlet of blunt spines .... 12.
12. Antennal style near the tip of the third joint, but in a hollow at the side and not apical; wings banded; front tibiae enlarged; frons of female with a single black spot in the middle .... **Epomyia**, new genus.
   Not with the above assemblage of characters .... 13.
13. Antennae with a terminal style; front tibiae not enlarged; wings not banded. **Psilocephala** Zetterstedt.
   The style projects from under the tip of the third antennal joint. **Furcifera** Kröber.

CAENOTUS, new genus.

Rather small, dark-colored species with hyaline wings. The genus is not closely related to any other described from North America. The antennae are short, with a very small subapical style and a few short bristles on the first two joints. The eyes are contiguous in the male and widely separated in the female; in the male the facets on upper two-thirds of the eye are much larger than those on the lower third, the line of demarcation being quite distinct. Frontal triangle in male very small. The eyes run to the bottom of the head, scarcely any cheeks being visible from the side; face small and bare. Proboscis and palpi long pilose. The body in general sparsely pilose, with no distinct spines on the thorax and abdomen, those on the legs being very small and hairlike. Genitalia of male quite prominent and differing from other known genera in general form; the female genitalia much as in *Thereva*, with a terminal circlet of spines. Abdomen of male about twice as long as thorax. Venation quite different from other known genera; vein Cu-1 coalesces with M-3 either at the base, there being no cell M-3 or m-cu cross vein, or there may be a partial coalescence as in *C. inornatus.*

Genotype.—*Caenotus inornatus*, new species.

TABLE OF SPECIES

1. Thorax with sparse erect white pile; vein Cu-1 coalescing with M-3 for most of its length (three veins from the discal cell)................**minutus**, new species.
2. Thorax with more dense yellowish white pile; slightly larger species; vein Cu-1 and M-3 united for a short distance near the base but ending separately and wide apart in wing margin (four veins from discal cell).
inornatus, new species.

CAENOTUS MINUTUS, new species.

Plate 1, fig. 4.

Male.—Length 4 to 5.5 mm. Head black, including the antennae, the pile white; small frontal triangle gray pollinose. Antennae short, the first joint about twice the length of the second, both with a few short hairs; third joint a little longer than the first two combined and much broader at the base, the apical portion ending in a microscopic bristle. Palpi blackish with long white pile.

Thorax and scutellum opaque black, thinly gray pollinose with sparse erect white pile, not dense enough to obscure the ground color. Pleura thinly gray pollinose with some fine white pile. Knobs of the halteres yellow, the stems yellowish brown.

Abdomen black, thinly gray pollinose with erect white pile, longer on the first four segments, short on the prominent genitalia; the two lateral lobes of the epiproct yellowish on the apical half and prolonged a little beyond the hypandrium. Legs black or blackish brown, knees yellowish; femora gray pollinose; bristles of legs small, fine, pale, hardly noticeable under low magnification. Wings hyaline, the veins brown or yellowish; R-4 nearly straight beyond the fork; Cu-1 coalescent with M-3 for most of its length, there being no m-cu cross vein or cell M-3 (fourth posterior cell); stigma yellowish.

Type locality.—Holotype, a male, taken at Alamogordo, New Mexico, April 26, 1902.

Type.—In the collection of the Philadelphia Academy of Natural Sciences. There are seven paratypes, two deposited in the National Museum, the others in the collection with the types; all were taken in the type locality, April 22 to May 1, 1902.

Paratype.—Male, Cat. No. 25926, U.S.N.M.

CAENOTUS INORNATUS, new species.

Plate 1, figs. 1, 2, and 3.

Male.—Length 5.5 to 6.5 mm. Very nearly like *C. minutus* in general structure, color, and habitus. The pile of the thorax is a little thicker and more yellowish. The yellowish lobes of the genitalia are very much the same. Knees, hind tibiae, except apices, basal portion of two front pairs of tibiae and base of hind metatarsi, yellowish; spines on tibiae stronger than in *C. minutus*. Halteres as in the above species. Wing venation nearly the same as in *C. minutus*, but Cu-1 and M-3 are united for a short distance near the base and end separately and wide apart in the wing margin. There is no m-cu cross vein or cell M-3. (See fig. 2.)

Female.—Length 8.5 mm. Head and thorax colored much as in the male. Head appears proportionately small and is black in ground color and gray pollinose; cheeks show slightly below the eyes. First two joints of antennae short pilose; antennae distinctly separated at the base. Frons pollinose and very short yellowish pilose; a depressed, shining median line from front ocellus to base of antennae; frons narrower at the ocelli, gradually widening below.

Pile of thorax much shorter than in male and more reclinate; pile of scutellum and pleura white and shorter than in male. Abdomen quite large at base and about three times as long as the thorax, the pile short, very sparse, and yellowish. The first three segments almost entirely shining blackish, incisure between second and third white; posterior margins of third and fourth yellowish; fifth, sixth, and seventh segments are largely shining brownish yellow. Venter colored much as the dorsum. Spines of the genitalia yellow. Coxae brown; femora and tibiae brownish yellow, the hind legs paler; tarsi except base of first joint brown, the spines more apparent because of the larger size of the specimen; front and middle tibiae about equal in length, the hind tibiae about half again as long. Wing venation about the same as in the male. In one wing of the type M-2 curves down to meet M-3 and Cu-1 slightly before the wing margin, in the other wing it goes straight out to the margin; the wings are faintly brownish yellow.

Type locality.—Holotype, a male, collected at Alamogordo, New Mexico, May 5, 1902, and allotype, a female, from the same locality, taken May 12, 1902.

Types.—In the collection of the Philadelphia Academy of Natural Sciences.

There are three male paratypes taken at the same locality from May 13 to 15. In these specimens there is a slight variation in the venation; in one wing of one specimen M-2 is reduced to a stump projecting from cell first M-2, in another specimen the vein does not reach the wing margin. One paratype is in the United States National Museum, the others are in the collection with the types.

Paratype.—Male, No. 25927, U.S.N.M.

Genus EUPHYCUS Kröber.

1912. *Euphycus* KRÖBER, Deutsche Ent. Zeitschr., vol. 7, p. 2.

This genus is near *Phycus* Walker. The first antennal joint is long and with bristles, the body thickly pilose and the males and females quite different in appearance. The only known species, *Euphycus setosus*, was described by Kröber. In the female the frons is shining black, the face silvery white.

Type locality.—Mexico.

Type.—In the Vienna Museum.

Genus HENICOMYIA Coquillett.

1898. *Henicomyia* COQUILLETT, Journ. New York Ent. Soc., vol. 6, p. 187.

The antennae are almost as long as the thorax, the third joint two and one-half to four times as long as the first, the second broader than long, the third joint of nearly equal diameter, almost twice as thick as the first, truncated at the tip and destitute of a style. Head nearly twice as broad as long; face bare; palpi as long as the proboscis and two-jointed. Frons of male broad and dull. Abdomen slender, three times as long as thorax. Legs long and almost entirely bare. Wings normal in venation, with one or more brown crossbands.

Genotype.—*Henicomyia hubbardi* Coquillett.

TABLE OF SPECIES.

1. Third antennal joint about four times as long as first; abdomen almost wholly black; one light brown band on the wing.............. **hubbardi** Coquillett.
2. Third antennal joint about two and one-half times as long as the first; fifth and sixth abdominal segments reddish yellow; two blackish brown bands on wing.. **varipes** Kröber.

HENICOMYIA HUBBARDI Coquillett.

Plate 2, figs. 5, 6, and 7.

1898. *Henicomyia hubbardi* COQUILLETT, Journ. New York Ent. Soc., vol. 6, p. 187.

This species is easily recognized from Coquillett's description, together with the figures given in this paper.

Type locality.—Fort Grant, Arizona.

Type.—Cat. No. 4071, U.S.N.M.

Distribution.—The single male specimen of this species examined was taken at Garces, Arizona, August, by Mr. Biedermann. This specimen answers the original description very well; it is in the collection of the department of agriculture, Harrisburg, Pennsylvania.

HENICOMYIA VARIPES Kröber.

1912. *Henicomyia varipes* KRÖBER, Stett. Ent. Zeit., p. 213.

In this species the third antennal joint is proportionately shorter than in *H. hubbardi.* The face is described as black, bare; the palpi much as in *H. hubbardi.* The wings are hyaline, with two blackish brown crossbands.

Type locality.—Mexico City, Mexico.

Type.—A unique male in Kröber's collection.

Genus NEBRITUS Coquillett.

1894. *Nebritus* COQUILLETT, Journ. New York Ent. Soc., vol. 2, p. 98.

Head flattened, slightly longer than broad, the frons almost horizontal; eyes almost round, the vertical diameter a little greater than the horizontal; eyes of male separated by a space about twice as wide as the ocellar tubercle. First antennal joint very large, almost as long as the head, shining, with strong bristles; second joint very small, the third rather long and slender, but distinctly shorter than the first; second and third joints dull. There is a distinct style on the outside of the third antennal joint situated in a hollow, or groove, about three-fourths the distance from the base (Coquillett and Kröber stated that the style was *wholly wanting!*). Proboscis slender and projecting beyond the prominent frons, the labellae almost as long as the proboscis proper. Palpi shorter than proboscis and subclavate. Face bare and retreating below. Thorax rather flattened, about one-half as long as the abdomen in the male and shorter in proportion in the female. Male genitalia rather small, but distinctly visible under low power, the anal flaps conspicuous. Pulvilli present, the empodia hairlike. Venation normal for the family; cell first M-2 (anal cell) closed, other cells on the wing margin open.

(Name from the Greek *nebritos*, like a fawn skin.)

Genotype.—Nebritus pellucidus Coquillett.

NEBRITUS PELLUCIDUS Coquillett.

Plate 3, figs. 8, 9 and 10.

1894. *Nebritus pellucidus* COQUILLETT, Journ. New York Ent. Soc., vol. 2, p. 98.

The original description is quite comprehensive. The length is 7 to 10 mm.

Type locality.—Southern California.

Type.—Female, Cat. No. 10424, U.S.N.M.

From the examination of several perfect specimens the following notes have been added: Proboscis blackish brown; second and third antennal joints velvety black, in two females the first joint entirely yellowish. There is a shining black stripe from the ocellar tubercle to the base of the occiput. The two median yellow vittae of the thorax are narrow, the yellow stripe above the pleural suture thickly covered with yellow tomentumlike pile, which is also present on the sides of the scutellum. The pile on the first four abdominal segments of the female is yellowish, the rest of the abdominal pile black and the circlet of bristles at the tip of the abdomen is black. The male genitalia (see fig. 10) are reddish yellow with long black pile. The male abdomen is yellowish gray pollinose and lacks the black spots present in the female, the posterior margin of the second segment is whitish; all of the dorsum of the abdomen is faintly silvery with short reclinate black pile; the pile on the venter and sides is longer, erect, and whitish; the sides of the abdomen are shining black and there are two shining black stripes on the venter; sixth segment scarcely visible, black pilose. Wing veins heavy and black, with a very faint outline of brown which gives them a heavier appearance; base of the wing yellowish.

Distribution.—All of the known specimens have been collected in California; specimens were examined from the following localities: Claremont (Cole), [Cole]; unknown locality in California (Univ. Minn. coll.); Bryson, May 18, 1920 (E. P. Van Duzee); Keen Camp, Riverside County, June 6 (E. P. Van Duzee), [both Cal. Acad. Sci.].

Genus OZODICEROMYIA Bigot.

1889. *Ozodiceromyia* BIGOT, Ann. Soc. Ent. France, vol. 9, p. 321.

The original description is translated as follows:

> Antennae much longer than the head, almost cylindrical, pilose, first segment longer than the head, second small, third equal to the first, with three or four indistinct rings, last segment, pyriform, blunt, the bristles indistinct; labrum narrow, genitalia apically short spinose (female); face bare, fourth posterior cell and anal cell closed before the margin of the wing.

Type.—In the Bigot collection, owned by J. E. Collin, Newmarket, England.

Only one species is known; from Mexico.

OZODICEROMYIA MEXICANA Bigot.

1889. *Ozodiceromyia mexicana* BIGOT, Ann. Soc. Ent. France, vol. 9, p. 321.

Black, hardly shining; thorax narrowly and obscurely bilineate; face and frons ornamented with shining black; halteres and legs rufous; femora, base broadly, apices of tibiae, anterior and middle tarsi infuscated; wings pale smoky, the base and margin yellowish. Length 9 mm.

Type locality.—"Mexico."

A single female specimen in the collection of the American Museum may possibly belong to this genus, and in many characters answers the description given of the species *mexicana*. The antennae are not as described, the first joint being distinctly shorter than the head, but the third is indistinctly annulate (with apparent but not actual segments). It is almost impossible to identify the species from the description given by Bigot, but if the type is still in existence it may some day be redescribed. The definite locality in Mexico where the specimen was collected is not known. The specimen in the American Museum is from the W. M. Wheeler collection and is labeled "Tizapan, D. F."

Type.—In the Bigot collection, now the property of J. E. Collin, Newmarket, England.

PHEROCERA, new genus.

This genus is closely allied to *Rueppellia*, judging from the description and the published figures of that genus. In general appearance it resembles *Psilocephala*. Only females are known, and in these the frons is convex at the antennae and characteristically marked; the cheeks are quite apparent but do not project far below the level of the eyes; the proboscis is like that of *Psilocephala*, the palpi cylindrical and not as long as the proboscis. The antennae are shorter than the head, the first and third joints about equal, the second about one-half as long; the style is slender, cylindrical, about as long as the third joint, and consists of two equal segments and an apical bristle; first two joints bristled below. There are strong spines above the dorso-pleural suture and on the scutellum. The femora are without spines; front tibiae with rather long pile and no spines except at apex. Genitalia of female very peculiar, the internal structure being hidden by the flat dorsal and ventral plates, which have no spines on them. The wing venation is very close to some species of *Psilocephala*, but there is more coalescing of the veins; R-4 is only slightly curved beyond the fork; veins M-3 and Cu-1 meet some distance before the wing margin, and after coalescing do not reach the margin.

Genotype.—*Pherocera signatifrons*, new species.

TABLE OF SPECIES.

1. Two oval black spots on face at base of antennae; upper half of frons gray pollinose.. **signatifrons**, new species.
   No black spots on face; upper half of frons shining black.................. 2.
2. Legs black; dorsum of thorax thinly gray pollinose with a median dark stripe and side spots.. **albihalteralis**, new species.
   Legs largely reddish yellow; dorsum of thorax shining black with two silvery pollinose vittae.. **flavipes**, new species.

PHEROCERA SIGNATIFRONS, new species.

Plate 3, figs. 11, 12, and 13.

Female.—Length 6 mm. General body color blackish brown, with gray or silvery pollinose areas. Frons much wider below than above, the upper half including the ocellar tubercle, gray pollinose; on the lower half of the frons an oval, shining, blackish brown spot, somewhat raised and reaching almost to the eyes on the sides. (See fig. 13.) Face, cheeks, and orbits silvery pollinose, the cheeks and palpi white pilose; palpi brown; proboscis blackish gray pollinose. At the base of each antenna and contiguous to the shining callosity of the frons is an oval black spot. Antennae black, the bristles below black and strong; first antennal joint a little longer than the third and twice as long as the second; style rather slender, two-jointed, and with an apical bristle, the whole about as long as the third joint of the antennae. Occiput gray pollinose with short black bristles above.

Thorax, scutellum, and pleura blackish, the color obscured by the gray pollen; there is a median brown dorsal stripe, widened in front and almost reaching the scutellum; an elongate brown spot on either side of the stripe. Scutellum with short, fine, white pile on the margin and two black bristles. Mesa and meta pleura with some white pile. Knobs of halteres blackish gray pollinose, the stem yellowish. Coxae colored as the pleura and with white pile.

Abdomen blackish, with whitish incisures on segments one to five, very narrow on the fifth; the very fine pile is whitish and reclinate; first segment mostly gray pollinose and a small amount on the posterior margin of the second, the rest semishining. Genitalia very peculiar in shape and with very short black pile; there is an upper and lower triangular plate, flattened and with no circlet of bristles as in most of the other genera. Legs mostly blackish, the femora thinly gray pollinose and white pilose, with no distinct bristles; tibiae more or less yellowish on the basal half, the front pair whitish; all the tibiae white pilose, the front ones with quite a thick covering of silvery white pile, obscuring the ground color from the front. Wings rather small, grayish hyaline, the venation near that of *Psilocephala* (see fig. 12); vein M–2 does not reach the wing margin; vein M–3 coalesces with Cu–1 and does not reach the margin.

Type locality.—Holotype, female, Alamogordo, New Mexico, May 5, 1902.

Type.—In the Philadelphia Academy of Natural Sciences.

There are four female paratypes in the collection of the Philadelphia Academy of Natural Sciences, collected at the same time and place, and one paratype in the National Museum. This species and the following are in a group having no near relatives north of the Mexican border; its origin is probably Central or South American.

The only known species of *Rueppellia*, which occurs in Egypt and Abyssinia, has a venation very nearly like that of the species of *Pherocera*, but the wing is shorter and broader according to the figure given by Verrall in British Diptera; the antennae also have a three-jointed style.

Paratype.—Female, No. 25928, U.S.N.M.

PHEROCERA ALBIHALTERALIS, new species.

Plate 3, fig. 14.

Female.—Length 5.5 mm. Closely resembling *P. signatifrons*, the antennae being very nearly the same. Most of the frons, including the ocellar tubercle, shining black, flat; the narrow margins and the face silvery pollinose. Proboscis black, palpi brownish yellow, white pilose.

Thorax black, the dorsum thinly gray pollinose, with a faint darker median stripe and two side spots. Scutellum with narrow shining black base, the rest whitish pollinose, with two black bristles. Pleura and coxae largely silvery gray pollinose, knobs of the halteres ivory white, stems brown.

Abdomen brownish black, semishining; faint traces of gray pollen on the first two segments and basal half of the venter; the short, sparse pile whitish and reclinate; narrow posterior margins of first three segments whitish. Genitalia of nearly the same structure as in *signatifrons*, with very short black pile. Legs black with black bristles, basal half of front tibiae whitish, the brown of the apex extending up some distance on the underside. Wings hyaline, the venation almost the same as in *signatifrons* (most of one wing broken off); stigma pale brown.

Type locality.—Alamogordo, New Mexico, June 6, 1902.

Type.—Female, in the Philadelphia Academy of Natural Sciences.

Only one specimen of this species is known. It is easily distinguished from *signatifrons* by the color of the halteres and the marking of the frons, and from *flavipes* by the general coloration.

PHEROCERA FLAVIPES, new species.

Plate 3, fig. 15.

Female.—Length 5 mm. Very much like the other two species of the genus in general appearance. General color black, with gray or silvery pollen and white, short, sparse pile. Frons shining black, narrow margins, and the face silvery pollinose; antennae apparently like those of the above-described species (the third joint broken off from one and the style from the other antenna).

Dorsum of the thorax shining black, with two widely separated silvery pollinose vittae, the posterior half largely silvery gray pollinose. Base of scutellum narrowly shining black, most of disk silvery white pollinose, the margin dull black with two bristles. Pleura and coxae silvery gray pollinose. Knobs of halteres white, the stems pale brownish.

Abdomen shining black, first segment gray pollinose, the rest shining; the short pile reclinate and whitish; pile on the last two segments black. Genitalia the same as in the other two species of the genus. Second and third abdominal segments with narrow posterior margins of white. Coxae partly yellowish, femora yellowish, the two front pair brown above; tibiae reddish yellow, white pilose, the tarsi blackish; front tibiae largely whitish yellow, with dense silvery white pile in front. Wing venation the same as in the other two species; vein M-2 reaches the margin of the wing in the single specimen.

Type locality.—Holotype, female, collected at Highley, Arizona, June 13, 1917, on Superstition Mountain (E. G. Holt).

Type.—In the collection of the United States Biological Survey.

The unique type is closely related to the other two species of the genus, but is distinguished by the marking of the thorax, the yellow femora, etc.

CHROMOLEPIDA, new genus.

Small species, very near *Psilocephala* in general appearance. Antennae long and slender, the first joint longer than the second and third, and with no distinct bristles, but short hairs. The orbital bristles are very short and set back from the vertex so that only a few show from the front. Eyes holoptic in the male and widely separated in the female. On the upper face just below the antennae are two shining black callosities. Cheeks projecting below the eyes more than is usual in *Psilocephala;* the palpi and proboscis are much the same. Mesonotum, pleura, and coxae more or less clothed with scales, many of which are iridescent; in perfect specimens there is a dense covering. This vestiture is not found in any other genus in the family. Abdomen of the male as in *Psilocephala,* but with scales on the dorsum, venter, and sides in addition to the pile; in the female there are very few scales. The male genitalia are of the general type found in *Thereva* and *Psilocephala,* as are the female genitalia. The wings are rather short, unusually short in proportion to the body in the female.

Genotype.—*Psilocephala pruinosa* Coquillett.

TABLE OF SPECIES.

First two antennal joints yellow; frons without a velvet black spot.
pruinosa (Coquillett).
First two antennal joints black; frons with a velvet black spot near the middle.
bella, new species.

CHROMOLEPIDA PRUINOSA (Coquillett.)

1904. *Psilocephala pruinosa* Coquillett, Proc. Ent. Soc. Wash., vol. 6, p. 91.

The original description, from a male specimen, is recognizable. There is a male of this species, evidently a paratype, in the Stanford University collection, taken at Managua, Nicaragua (C. F. Baker). The specimen is labeled "*Psilocephala pruinosa* n. sp., det. Coq."

Type locality.—Granada, Nicaragua.

Type.—Male, No. 7795, U.S.N.M.

In the specimen examined the thorax is very thinly gray pollinose and very few of the characteristic scales remain, the specimen being somewhat rubbed. The trochanters are brown and the coxae black; some of the scales of the pleura and coxae are quite large and iridescent; the pile is sparse and whitish. Before the scutellum the scales are much smaller and yellowish. The scales of the dorsum of the abdomen are slender and silvery white.

CHROMOLEPIDA BELLA, new species.

Plate 3, figs. 16, 17, and 18.

Male.—Length 5.5 mm. Head black, the upper half of the eyes with much larger facets than the lower (a more marked difference than in *Thereva* and *Psilocephala*); two narrow blue stripes across the middle of each eye. Face with two shining black callosities below the antennae as in *C. pruinosa*, whitish pollinose around the callosities; callosity above the antennae shining black. Pile of cheeks and occiput white; antennae black, the first joint a little longer than the second and third combined, slender, cylindrical (see fig. 17); the first two joints with short black pile, a few more bristlelike at the apex of the first joint; a very small subapical style on the third joint. Middle of frontal triangle with a velvet black crossband, above and at sides whitish pollinose.

Thorax black, thinly gray pollinose, thickly clothed with yellowish white scales above and iridescent ones on the sides and pleura; the pile very sparse and white. Coxae and trochanters black, the coxae with iridescent scales. Halteres yellow, the base of the stem brown. Scutellum gray pollinose, with four bristles.

Abdomen black above, the last three segments and genitalia largely reddish yellow; pile of abdomen white, yellowish on the genitalia; upper lamellae of genitalia large. Dorsum of abdomen whitish pruinose and with silvery white tomentum; venter reddish yellow, with pale pile and yellowish scales. Femora, tibiae except apex and base of tarsi yellowish, the rest of the legs black. Femora with only a few short bristles below, three to six on the hind ones. Wings yellowish gray, hyaline in places, darkened near the apex; stigma and costa yellow; cell M-3 closed and petiolate.

Female.—Length 6 to 7 mm. Very nearly as in the male. The shining black callosity above the antennae broader, above this a black velvet spot on each side near the eye (see fig. 16); upper frons yellowish gray pollinose, ocellar tubercle flat. Pleura and sides of mesonotum seem more densely covered with beautiful iridescent scales than in the male. General infuscation of wing as in the male; no distinct apical spot. The color of the abdomen evidently varies from reddish to almost black; pale sparse pile on the first three segments, black beyond; thick covering of scales at base of abdomen.

Type locality.—Holotype, male, and allotype, female, collected on the sand dunes near San Francisco, California, June 6, 1920 (F. R. Cole).

Type.—Cat. No. 25929, U.S.N.M.

Paratypes.—A single male paratype in the National Museum, collected in Ormsby County, Nevada, July 6 (C. F. Baker), was sent to Kröber by the National Museum and was returned labeled "n. gen. et sp., near *Ozodiceromyia.*" Several paratypes are in the Cornell University collection, taken at Felton, California, May 25, 1908 (J. C. Bradley). Two paratypes in the Stanford University collection were collected at Palo Alto; other paratypes are in the California Academy of Sciences and in the writer's collection, taken in the type locality. Paratypes from the writer's collection were sent to the British Museum, Philadelphia Academy of Natural Sciences, Museum of Comparative Zoology, C. W. Johnson, and Prof. M. Bezzi.

On the date that the types were collected the writer went out to the sand dunes at the edge of Golden Gate Park, near San Francisco, in company with E. P. Van Duzee, and a good series of this remarkable little species was taken. They were running over small open spaces out in the dune vegetation and did not get out in the wind-swept open sand. None of the specimens were seen to fly more than a few inches and none were swept from vegetation. The males seemed to be more active than the females; when seen from above they blend with the dead brush and dune land over which they run and fly.

Genus FURCIFERA Kröber.

1911. *Furcifera* KRÖBER, Ann. Mus. Nat. Hung., vol. 9, p. 524.

The genus is near *Psilocephala*, judging from the description. The third antennal joint is longer than the first and second combined, the first about three times as long as the second; the style is on the underside of a strongly produced tip. The abdomen and legs are relatively long, the fore metatarsi thickened.

The only species known, *F. fascipennis* Kröber, is described from a female. The upper part of the frons is semishining black, the face and lower frons silvery white, between the two colors a velvet black spot. The wings have a dark brown crossband.

Type localities.—Oaxaca, Mexico; Brazil.

Type.—In the Hofmuseum, Vienna.

EPOMYIA, new genus.

Nearly related to *Psilocephala* and *Furcifera*, four of the species having been taken from the former genus. No specimens of *Furcifera* were available for comparison, but from Kröber's description it is clear that the genus is close to *Epomyia;* both genera have enlarged metatarsi and a velvet black spot in the center of the frons and the antennae are evidently allied in structure. All of the known species of *Epomyia* have rather long, slender antennae, the third joint longer than the first and of a peculiar shape, the tip broad and hollowed out on the outside, the small style fitting in the excision. (See figs. 30, 31, 32, 36, and 37.) The bristles on the first and second joints are very short and hairlike. There is a more or less elongated velvet black spot on each shoulder inside the humeral callosity. The scutellar bristles are very short and in some species variable in number. The wings are banded and are proportionately small, especially in the females, which have rather long slender abdomens. The venation is like that of *Psilocephala*, cell M-3, however, being closed in all the species and petiolate like the cell first A (anal cell).

Genotype.—*Psilocephala pictipennis* Wiedemann.

TABLE OF MALES.

1. Scutellum orange red .... **scutellaris** (Loew).
   Scutellum black .... 2.
2. First antennal joint about as long as the third .... **sumichrasti** (Bellardi).
   First antennal joint much shorter than the third .... 3.
3. Margin of scutellum with short yellow pile; wings almost entirely whitish hyaline; abdomen often largely reddish .... **rufiventris** (Loew).
   Margin of scutellum without yellow pile; abdomen black.
   pictipennis (Wiedemann).

TABLE OF FEMALES.

1. Abdomen largely red; two faint blackish bands on the wings. **rufiventris** (Loew).
   Abdomen black .... 2.
2. Scutellum orange red .... **scutellaris** (Loew).
   Scutellum black .... 3.
3. First antennal joint much shorter than the third.... **pictipennis** (Wiedemann).
   First antennal joint about as long as the third .... 4.
4. Antennal style subapical and not projecting beyond the end of the third joint; wings with two narrow hyaline crossbands; southern species.
   bella, new species.
   Antennal style projecting beyond the tip of the third joint; wings with a wide median hyaline crossband; tropical species.......... **sumichrasti** (Bellardi).

EPOMYIA RUFIVENTRIS (Loew.)

Plate 4, figs. 19, 25, and 37.

1869. *Psilocephala rufiventris* LOEW, Berlin. Ent. Zeitschr., vol. 13, p. 12.

Male.—Length 5.5 mm. to 6.5 mm. Head black, face and most of the frons silvery white pollinose, the upper corner of frontal triangle velvety black. Pile of proboscis and palpi short, brownish. First two joints of antennae yellowish, with short black hairs, the third joint slightly longer than the first two combined and wider than either. Occiput thin silvery pollinose and white pilose; post-ocular bristles black.

Thorax black, largely blue-gray pollinose, a large velvet black spot over the humeri, reaching back to the suture; two silvery vittae inside the black spots; a few whitish hairs on the mesonotum. Scutellum velvet black, without pile, on disk its base narrowly grayish, the margin with about four short black bristles. Pleura black, blue gray pollinose with sparse white pile. Knobs of halteres large, blackish, the stem paler. Pteropleura shining black.

Abdomen black, first three segments silvery gray pollinose, the fourth to sixth segments shining black; a few black hairs on sixth segment, the rest of the abdominal pile white. Genitalia reddish yellow with reddish bristles and hairs. The second abdominal segment is as long as the fourth, fifth, and sixth combined. Femora black, tibiae black with brown tips; fore tarsi entirely blackish, dilated, with short black pile; hind tarsi yellow except the tips (in some specimens only the base yellowish); femora with reclinate silvery white pile. Wings whitish hyaline, with an apical gray spot on R–4 and a spot near the middle of the wing (remnant of a crossband found in the female); cell M–3 closed, the stigma brown. The markings on the wings of some males are almost obsolete.

Female.—Length 7 to 9 mm. Many characters like the male. Frons narrow, shining black above, the lower half and ocellar tubercle silvery gray pollinose; in the center of the frons a small transverse velvet black spot. (Fig. 25.) Antennae pale brown, first two joints more or less yellowish.

Thorax nearly as in the male, the pile very short, reclinate, and yellowish; bristles short; a few short erect hairs on margin of scutellum. Pleura blackish gray pollinose, the pteropleura bare and shining; very short pile on pleura and coxae. Knobs of halteres brown, the stems paler.

First abdominal segment blackish, gray pollinose and with very short yellowish pile; the rest of the abdomen usually bright reddish yellow, the incisures darker, the venter the same as the dorsum; pile of first three segments pale, beyond this short, black, erect. Short yellow pile on the genitalia and the circlet of bristles yellowish.

Legs as in the male. Wings whitish hyaline, with two dark-gray bands, one near the apex, the other near the middle of the wing (see fig. 19); cell M-3 closed and petiolate, the stigma brown.

Type locality.—Nebraska.

Type.—In the Museum of Comparative Zoology, Cambridge.

Specimens examined, 16 males, 24 females.

Distribution.—The distribution according to 16 males and 24 females is:

Canada: Ontario, June 6 [Canad. coll.]; Burlington, Ontario, June (H. C. Huckett), [Cornell].

Rhode Island: Buttonwoods, July 25 (C. W. Johnson).

Massachusetts: Woods Hole, July 23 (W. M. Wheeler); Horses Neck Beach, August 3 (Hough).

New Jersey: Clementon, May 30 [Univ. of Kans.]; Pleasantville (Phil. Laurent) [Harrisburg coll.], also Stone Harbor, July 5 (Daecke).

Virginia: Virginia Beach, August 11 (Knab), [U. S. Biol. Survey].

Maryland: Beltsville, May 25, June 14, July 1 (McAtee) and June 28 (Jackson), [U. S. Biol. Survey]; Camp Meade, June (R. C. Shannon), [Shannon].

Florida: Palatka, May 4 (Bradley), [Cornell].

District of Columbia: Washington (Banks), [Cole].

Ohio: Sandusky, June 8 (Hine), [Hine].

Indiana: Whiting, August 13 (W. M. Wheeler), [Amer. Mus.]; Plymouth, July 15, "predaceous on cutworms" (H. K. Laramore), [Cole].

Illinois: Lake Forest, June 11 [Cornell]; Chicago, May 28 (W. M. Wheeler), [Amer. Mus.].

Michigan: Agricultural College, June 9 to August 11 [Cornell].

Montana: "Montana" [Kans. Univ.].

Nebraska: "Fr. Mt.," July 9 to 21 [Amer. Mus.].

EPOMYIA SCUTELLARIS (Loew).

Plate 4, figs. 26, 29, 30, and 35.

1869. *Psilocephala scutellaris* LOEW, Berlin. Ent. Zeitschr., vol. 13, p. 171.

Male.—Length 6.5 to 8 mm. Head black, face silvery white pollinose, the lower part of frontal triangle more gray, the upper part filled with a diamond-shaped velvet black spot. Antennae of medium length, with short hairs on the first two joints as in the other two species of the genus (see fig. 30), the first two joints reddish yellow, the third slightly longer than the first two together and brown in color. Pile of palpi short and black. Occiput gray pollinose and white pilose.

Thorax gray-black with two broad opaque black bands from humeri almost to base of wing. Pile short, yellowish, tomentumlike. Scutellum orange-red, the base narrowly blackish, a few short black erect bristles near posterior margin and usually four short, erect black bristles. Pleura black, gray pollinose, thinly white pilose, the pteropleura largely shining. Knob of halteres brown, the stem yellowish.

Abdomen black, the dorsum mostly silvery pollinose with short white pile, longer at the sides of the first segment; second segment with a silky white posterior border; segments 1, 4, 5, and 6 more blue-gray pollinose; the last three segments very short, their combined length less than that of the second and about equal to that of the third; these segments shining blackish with yellowish pile. Genitalia reddish yellow with golden yellow pile, the upper forceps deeply excavated and projecting beyond the lower. There is black pile on segments 3 to 6 of the venter. Femora blackish brown; hind tibiae brown, the anterior ones yellowish brown; fore tarsi enlarged and blackish, the first joint of other tarsi and base of second yellowish, the rest brown. Wings hyaline, the apex pale grayish, much shorter than in the female; costal cell and veins at base of wing yellowish, the stigma pale brown; cell M-3 closed and petiolate.

Female.—Length 8 to 10 mm. Closely resembling the male in most characters. Almost bare of pile. Frons narrow, the upper half shining black, the lower gray-white pollinose; between the colors a diamond-shaped spot, velvet black in color, in some specimens rounded below and pointed above.

Tomentumlike pile of thorax shorter than in male. Mesonotum with two faint gray-blue vittae, on either side a more whitish stripe bodering the opaque black one over the humeri. The short bristles of the scutellum quite variable, two, three or four being present and these often differing in size. Halteres light yellowish brown, the tips of the knobs darker.

Abdomen black, semishining; pile on two basal segments whitish, beyond with usual short, black, erect pile on dorsum and venter. Genitalia reddish yellow with a yellowish circlet of bristles. Legs colored about as in the male; fore tarsi blackish with many short, black, bristlelike hairs, and enlarged as in the other sex. Wings with crossbands more definite than in the male (see fig. 29); cell M-3 closed and petiolate.

Type locality.—District of Columbia.

Type.—In the Museum of Comparative Zoology at Cambridge.

Distribution.—The following localities are given for two males and three females:

North Carolina: Black Mountains, June [Amer. Mus.].

New York: Van Cortland, June 22 and July 11 (J. L. Zabriskie), [Amer. Mus.]; Mosholu [Amer. Mus.].

Kröber gives New York and Brazil for the male and adds a record from Paraguay for the female.

EPOMYIA PICTIPENNIS (Wiedemann).

Plate 4, figs. 20, 22, 28, 34, and 36.

1821. *Thereva pictipennis* Wiedemann, Dipt. Exot., p. 113.
1869. *Psilocephala erythrura* Loew, Berlin. Ent. Zeitschr., vol. 13, p. 172.

Male.—Length 6 to 7 mm. Frontal triangle and face silvery white, the upper corner of triangle velvet black. Antennae slender, cylindrical, the third joint slightly longer than the two first combined, with short hairlike bristles (see fig. 36); the first two joints yellowish, the third yellowish brown. Pile of head short, whitish; that on the palpi very sparse.

Thorax blue-gray pollinose; base of scutellum whitish, the rest velvet black; the usual black stripe inside of the humeri. Bristles of the scutellum short, erect, black. Halteres black, the stem paler. Pleura with scant white pile.

Abdomen silvery white tomentose above, the ground color black, thinly gray pollinose. Genitalia reddish yellow, with yellow pile above, some black below. Legs blackish brown, with white pile on the femora and coxae; four hind tibiae and the two basal joints of the hind tarsi yellowish. Wings hyaline (said to be pale yellowish in fresh specimens); stigma and veins brown; vestiges of two blackish bands, one near the tip of wing, the other near the middle; cell M-3 closed and long petiolate.

Female.—Length 7 to 9 mm. Resembling the male in most characters. Upper part of frons and the ocellar tubercle shining black, the lower part silvery white pollinose, a velvet black spot in the middle between the two colors (fig. 20). Face silvery white pollinose; frons and face bare of pile; top of occiput shining blackish, the rest whitish pollinose with very sparse, short white pile. Proboscis and palpi black, very short white pilose.

Thorax colored as in the male; blue-gray pollinose, the two black stripes very definite; in the center between these stripes a narrow dark-brown stripe; next to the broad black vittae and along the lateral margins of the thorax the pollen is silvery. The white base of the scutellum very marked, the rest of the surface black, as in the male. Pile of the thorax mostly black, very minute. Halteres as in the male.

Abdomen a peculiar slate black, the thin covering of gray pollen giving a blue tinge; pile very sparse, short whitish on the first three segments, denser, and short erect black on the remainder of the abdomen, including the genitalia; circlet of spines on the genitalia yellowish. Femora dark brown, pile very short, pale, the bristles small and black; fore tibiae and tarsi black, the fore metatarsi enlarged as in the other species of the genus, the other tibiae except the tips and the basal joints of the tarsi yellowish brown. Wings longer than in the male, the bands much broader, in some specimens the whole wing more or less infuscated; venation as in the male (fig. 22).

Type locality.—Savannah, Georgia.

Type.—The type of *P. erythrura* Loew is in the Museum of Comparative Zoology, Cambridge. Wiedemann's type is presumably in the Westermann collection now in the Zoological Museum, Copenhagen.

Distribution.—Distribution according to 5 males and 27 females is:

Massachusetts: Groton, July 8 (C. W. Johnson), [Cole].

Connecticut: New Haven, June 9 (H. B. Kirk), [Harrisb. coll.].

New Jersey: Riverton, June 15 (Daecke), [Harrisb. coll.]; Riverton, July 7 and 11 (C. W. Johnson), [Cole].

New York: Sanford (M. C. Van Duzee); Orient, July 12 (Zabriskie), [both Amer. Mus.].

Maryland; Beltsville, June 15 (McAteo), [Biol. Survey]; Bladensburg, June 23 (R. C. Shannon), [Shannon].

North Carolina: Black Mountains [Amer. Mus.].

Georgia: Thomasville, July 22 [Amer. Mus.]; Tifton, September 3 [Kans. Univ.].

Florida: St. Augustine, March 15 (C. W. Johnson), [Cole]; Crescent City, April 20 (M. C. Van Duzee), [Amer. Mus.]; Palatka, May 4 (Bradley), and Fort Meyers, May 7 (Bradley), [both Cornell]; Enterprise, April 15; Key Largo, November 6; Gotha, March (W. M. Wheeler); Clearwater, April 1 to 30 (M. C. Van Duzee); St. Petersburg, April 28 (M. C. Van Duzee); Fort Meyers, March 31; Estero (M. C. Van Duzee), [all Amer. Mus.].

Illinois: Chicago, June 10 (M. W. Wheeler), [Amer. Mus.].

Texas: Galveston, June 5 (W. M. Wheeler), [Amer Mus.].

Kröber records the species from the type locality and from the following places: Tifton, Georgia; Atco and Westville, New York; Riverton, New Jersey; Toronto, Ontario, Canada.

EPOMYIA SUMICHRASTI (Bellardi).

Plate 4, figs. 23, 24, 32, and 33.

1862. *Psilocephala sumichrasti* BELLARDI, Saggio di Ditter. Messic., pt. 2, p. 91.

The original description makes the species recognizable. Bellardi described only the male.

Type locality.—Tuxpango near Orizaba, Mexico.

Type—In the collection of Bellardi, Turin, Italy.

The following notes are made from two specimens in the Stanford University collection, determined as *sumichrasti* by Coquillett, and seeming to fit the original description except in the relative length of the antennal joints. The specimens, a male and female, were collected at Granada, Nicaragua, by C. F. Baker.

Male.—Length 7.5 mm. Ocellar tubercle gray pollinose. Antennae brownish yellow, the first joint about as long as the third (see fig. 32), the style and bristles short. Lower part of the head with whitish pile. There are indications of a median colored crossband on the eye, probably quite apparent in life.

Pile of mesonotum short and yellowish. On each side, over the humeri, a velvety brown spot; mesonotum largely gray pollinose. Scutellum velvety black, with three or four short black marginal bristles, a few black pile on the margin (the rest may be rubbed off). Halteres yellowish brown.

Abdomen not flattened at the tip; some black pile below on the fourth segment, all the pile of the fifth and sixth black and rather dense; pile on the basal segments whitish. Genitalia reddish yellow, with reddish yellow pile, the lower claspers slightly longer than the upper (see fig. 33). In the specimen examined the anterior legs are entirely yellowish brown.

Female.—Length 9 mm. Closely resembles the male. Frons narrow, with the usual markings of the genus. (Fig. 24.) Some blackish pile on the oral margin below and on the proboscis. Mesonotum with two narrow shining black vittae, just inside the humeral brown spots. Scutellum as in the male, with four marginal bristles. Genital segment reddish yellow, the rest of the abdomen black; second segment with a white posterior border; first segment gray pollinose, as are sides and posterior margin of second and most of third and fourth, the rest shining blackish brown, with short erect black pile. Wings largely infuscated. (Fig. 23.)

EPOMYIA BELLA, new species.

Plate 4, figs. 21, 27, and 31.

Female.—Length 9.5 mm. Head black, with more or less whitish pollen which extends across the frons above the antennae (fig. 21); upper part of frons and ocellar tubercle shining and bare. Face and occiput whitish pollinose, the bristles of the occiput short and black; proboscis and palpi brown, short black pilose. The antennae about as long as the head, yellowish, the third joint about as long as the first, ending bluntly, and brownish yellow in color; short black hairs on first two antennal joints and base of third. (Fig. 31.)

Thorax black, gray pollinose (markings in the type obscured by grease, if present), with sparse yellowish, tomentumlike pile. Scutellum velvety blackish brown and bearing two short marginal bristles, the base narrowly gray pollinose. Pteropleura partly reddish in ground color, the remainder of pleura black, gray pollinose. Halteres yellowish.

Abdomen yellowish red, darker toward the tip; venter the same color; posterior margins of third, fourth, fifth, and sixth segment of dorsum blackish; circlet of spines on the genitalia and most of the short pile yellowish; the short erect pile of segments four to seven black, some black pile at base of eighth. Coxae and femora yellowish, the hind coxae with short apical spines; tibiae brownish yellow, the front pair darker apically; front tarsi blackish, the others paler. Wings with much the same venation and marking as in *E. scutellaris* Loew (fig. 27); the costal cell and stigma yellowish; a large part of the wing infuscated, the extreme apex, a subapical, and a median band whitish hyaline.

Type locality.—Macdona, Texas, July 29, 1911 (H. A. Wenzel).

Type.—A female. In the Philadelphia Academy of Natural Sciences.

Only the unique type is known. It is closely related to the other species of the genus and very probably has its center of distribution in Mexico or Central America.

Genus PSILOCEPHALA Zetterstedt.

1838. *Psilocephala* ZETTERSTEDT, Ins. Lappon. Dipt., p. 525.

Usually small or medium sized species. Head nearly semicircular, the frons more vertical than horizontal, thus differing from *Nebritus* and *Metaphragma;* occiput well developed, but the cheeks rather narrow. Antennae porrect and set on more or less of a protuberance, varying greatly in shape and size in different species, but never longer than the head; the first joint often quite large, the second always short, the third usually longer than the first and with a more or less apparent apical style; the first two joints with bristles and hairs. The males are holoptic, the eyes of the female widely separated. The frons of the female may be entirely pollinose, may possess two black spots or be largely shining black, the markings being of specific value. Kröber includes a few species in the genus in which the eyes of the male are narrowly or even widely separated, and there is one North American species, *P. latifrons*, placed provisionally in this group. The face is bare and usually silvery pollinose; palpi club-shaped and long pilose; the mouth parts are rather large.

The thorax is oval, seldom very convex, often quite thickly erect pilose in the male, as a rule sparsely reclinate pilose in the female. There is a remarkable uniformity in the chaetotaxy of *Psilocephala* and *Thereva*, the specific variation being little, if any, and yet there is a great deal of individual variation. The praesuturals and supra-alars are present, one postalar and one or two pairs of praescutellar bristles. The scutellum is of medium size, semicircular, and with one or two pairs of marginal bristles. The metanotum is small, bare, and almost concealed by the scutellum.

The abdomen is more or less conical and is usually much shorter in the male than in the female, although longer than the thorax in all the species. Male abdomen with seven obvious segments, the last two very small; dorsum of the first six in some species densely silvery pollinose and flattened. Male genitalia often quite large, the structure easily made out, and of specific importance, offering more definite specific differences than in *Thereva* and quite variable in general shape; the epiproct and hypandrium are usually shining, never thickly pollinose. The eighth segment of the female forms the base of the ovipositor and there is a terminal circlet of spines. In the female the abdomen is often apparently bare of pile at low magnifications, the pile on the fifth to eighth segments very short and erect. Legs slender and usually red or yellow and black; sparse pile on the coxae in addition to the bristles; pile on the femora mostly short and reclinate and short on the hind femora. There are about two coxal bristles in front, four on the middle and hind pair; usually two bristles below near middle of anterior femora; an irregular anteroventral row of six or seven on the hind femora; tibiae with rows of small bristles and several apical larger ones, the bristles of the anterior pair not extending to the base. Wing venation typical of the family, cell M-3 more often closed than open, in some species petiolate; the wings in a few species spotted, never banded as in the related genus *Epomyia*, usually hyaline or with a mark on the outer side of cell first M-2 (discal cell); in some species there is a sharp curve in the upper fork of the radial vein.

SYNOPSIS OF MALES.[a]

1. First antennal joint unusually thick; pile of the mesonotum tomentumlike; hypopygium large.. 2.
   First antennal joint usually rather slender; more or less erect pile on the mesonotum.. 4.
2. Pile of the genitalia and mesonotum yellowish; bristles of the occiput yellow. **variegata** Loew.
   Pile of genitalia largely black; orbital bristles black.................... 3.
3. Pile of mesonotum golden yellow; two scutellar bristles. **variegata flavipilosa**, new subspecies.
   Pile of mesonotum silvery white; four scutellar bristles. **variegata occidentalis**, new subspecies.
4. Wings broad and densely spotted with brown; R-4 acutely bent near tip.. 5.
   Wings usually hyaline, never spotted; R-4 not sharply bent down before the tip.. 6.
5. Apex of frontal triangle with a black spot.................... **acuta** Adams.
   Apex of frontal triangle golden brown........................ **tergissa** (Say).
6. Abdomen rather flattened above, shining black on the sides, silvery on the dorsum (*haemorrhoidalis* group).................................. 7.
   Abdomen more or less rounded, usually pollinose on the sides............ 15.

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[a] The eight new species in Kröber's 1914 paper are not included in the synopses of species. Walker's species are omitted, being unrecognizable from the descriptions, also *occipitalis* Adams, not seen by the writer. The female of *festina* Coquillett runs to couplet 28; the frons is entirely gray.

7. Halteres black .... 8.
Halteres yellow .... 13.
8. Genitalia with two clumps of black bristles on the hypandrium, the rest of the pile of the genitalia pale; frons with a wide median shining black patch.
frontalis, new species.
Pile of genitalia mostly black; no conspicuous bristles on the tips of the plates of the hypandrium; frons with a narrow wedge of shining black.
haemorrhoidalis (Macquart).
Genitalia and frons not as described .... 9.
9. First two antennal joints yellowish .... **arizonensis**, new species.
First two antennal joints black .... 10.
10. Costal cell blackish brown, the rest of the wing hyaline .... **costalis** Loew.
Costal cell hyaline or slightly infuscated .... 11.
11. Mesonotum vittate; femora yellowish brown .... **notata** (Wiedemann).
Mesonotum dull-gray pollinose except on the margins; legs almost wholly black .... 12.
12. Legs usually entirely black, as are the halteres; wings with a dark discal spot.
signatipennis, new species.
Bases of tibiae reddish; no definite discal spot .... **platancala** Loew.
13. Halteres brownish yellow; mesonotum and scutellum with golden tomentumlike pile .... **flavipennis**, new species.
Halteres bright yellow .... 14.
14. Mesonotum somewhat shining, faintly whitish vittate; stigma and wing veins very pale yellow .... **laerigata** Loew; **aldrichi** Coquillett.
Mesonotum and scutellum gray-brown pollinose except sides, which are shining .... **lateralis** Adams.
15. Hypopygium large, shining black; cell M-3 closed; frons bare and silvery pollinose .... **munda** Loew.
Hypopygium not large and shining black .... 16.
16. Eyes separated by the width of the ocellar tubercle; cell M-3 wide open.
latifrons, new species.
Eyes holoptic, or nearly so .... 17.
17. Knob of the halteres yellow or whitish .... 18.
Knob of the halteres blackish .... 25.
18. Femora yellowish .... 19.
Femora black .... 20.
19. Thorax and abdomen yellow .... **occipitalis** Adams.
Thorax and abdomen black, abdomen silvery white pollinose.
montivaga Coquillett.
20. Second, third, and fourth abdominal segments shining reddish.
aurantiaca Coquillett.
Abdomen not colored thus, usually black and pollinose .... 21.
21. Large western species; gray pollinose; genitalia large; apex of knob of halteres whitish .... **limata** Coquillett.
Smaller and usually more slender species .... 22.
22. Abdomen largely yellow in ground color; third antennal joint and its style very slender .... **festina** Coquillett.
Abdomen black in ground color .... 23.
23. Heavy bodied species, about 9 mm. in length; genitalia black in ground color; thorax not vittate .... **pollinosa**, new species.
Much smaller species; genitalia yellowish .... 24.
24. Erect pile on mesonotum rather long; upper corner of frontal triangle blackish.
cinerea, new species.
Pile of mesonotum short; upper corner of frontal triangle brown pollinose.
morata Coquillett.

25. Pile of body largely black; first antennal joint rather thick.... **pavida** Coquillett.

Pile of body largely white; first antennal joint rather slender .... 26.

26. Upper fork of Rs strongly bent; tropical species............ **senilis** (Fabricius).

Upper fork of Rs not strongly bent; species of more northern distribution.. 27.

27. Third antennal joint very short; pile of the genitalia whitish.. **baccata** Coquillett.

Third antennal joint about as long as the first and second combined. **argentifrons**, new species.

TABLE OF FEMALES.

1. Only lower corners of frons silvery pollinose, the rest shining black and more or less convex; cell M-3 closed and petiolate (*haemorrhoidalis* group)...... 2.

Frons largely covered with pollen, usually entirely so.......... ... . 12.

2. Femora yellowish brown............ **johnsoni** Coquillett; **notata** (Wiedemann).

Femora black... 3.

3. Halteres yellow.. 4.

Halteres black, at least the knob black............................. 7.

4. Halteres brownish yellow, not bright yellow; tomentumlike pile of mesonotum and scutellum golden; eastern species............ **flavipennis**, new species.

Halteres bright yellow... 5.

5. Mesonotum dense gray pollinose in the central part, the margins shining black; front tibiae entirely black; wings yellowish and pale brownish. **lateralis** Adams.

Mesonotum not marked thus, with whitish vittae; base of tibiae reddish.... 6.

6. Upper half of frons gray pollinose........................... **laevigata** Loew.

Frons almost entirely shining black; thoracic vittae very distinct; wing veins very pale yellow.................................. **aldrichi** Coquillett.

7. First two joints of antennae yellowish red; western species. **arizonensis**, new species.

First two joints of antennae black................................. 8.

8. Wings with a distinct blackish discal spot; legs entirely black in typical specimens; halteres wholly black............ ...... **signatipennis**, new species.

Wings with an inconspicuous discal spot or generally infuscated; all tibiae usually reddish at base.. 9.

9. Front tibiae black, base of hind tibiae reddish; costal cell blackish brown. **costalis** Loew.

All the tibiae reddish at the base................................. 10.

10. Lower corners of frons with a triangle of silvery pollen reaching up from the face; mesonotum with a blackish median vitta; species found east of the Rocky Mountains.................................. **haemorrhoidalis** (Macquart).

Lower corner of frons not with a silvery triangle, a narrow strip reaching from the face a short distance up along the eye margin............ .... 11.

11. Wings largely infuscated; mesonotum with a faint median vitta; western species. **platanoala** Loew.

Wings hyaline except for a small discal spot; mesonotum with a distinct dark median vitta; eastern species....................... **frontalis**, new species.

12. Upper two-thirds of frons shining black, the lower third silvery pollinose; antennae rather short... 13.

Frons entirely pollinose, sometimes with darker markings................. 14.

13. Upper part of frons flattened, rough, the lower part bare of pile; base of tibiae reddish.. **munda** Loew.

Upper part of frons convex, with a median impressed line, the lower portion with a few short black pile; legs black..................... **melampodia** Loew.

14. Frons with velvet black spots...................................... 15.

Frons without black spots.. 22.

15. First three abdominal segments largely shining red; frons very narrow and with two small black spots.. 16.
Abdomen not colored thus and densely pollinose........................... 17.

16. Bristles of the body and the thoracic calli black.......... **aurantiaca** Coquillett.
Bristles of body and thoracic calli yellowish............ **subrufa**, new species.

17. Lower angle of eye acute; wings largely dark gray, spotted white; frontal black spots small; western species.................................. **acuta** Adams.
Lower angle of eye acute; cross veins clouded and a few other spots on the veins; frontal spots large; the upper part of frons darker than lower; eastern species. **tergissa** (Say).
Lower angle of eye not acute; R–4 not so deeply bent near tip as in *tergissa* and *acuta;* species with a narrower frons.. 18.

18. Frons with a median black triangle in addition to the spot on each side next the eyes; third antennal joint about as wide as the first, and longer. **montivaga** Coquillett.
Frons with only two velvet black spots.................................. 19.

19. First antennal joint distinctly wider than the third and about as long, with long black bristles; pile largely black........................ **pavida** Coquillett.
First antennal joint more slender than the third......................... 20.

20. Femora yellow; abdomen largely yellow.................. **slossoni** Coquillett.
Femora black; abdomen black in ground color.............................. 21.

21. Knob of halteres and hypopygium black. **cinerea**, new species, **baccata** Coquillett.
Knob of halteres and hypopygium yellow.............................**morata** Coquillett.

22. Frons with two diverging lines of black from the base of the antennae; large boreal species, about 16 mm. in length; femora and tibiae black. **grandis** Johnson.
Frons without any markings of this kind; smaller species.................. 23.

23. Femora yellow; abdomen largely yellow.....................**placida** Coquillett.
Femora blackish brown or black... 24.

24. Abdomen with reddish brown side spots and reddish apex; hind femora deeply furrowed; tropical species.............................. **senilis** (Fabricius).
Abdomen black in ground color.. 25.

25. First antennal joint greatly swollen and strongly bristled, longer than the third joint; a dark mark from the base of the antennae to the eye margin....... 26.
First antennal joint smaller than the third.............................. 28.

26. Pile of mesonotum short and black; wings largely clouded; western species. **fuscipennis**, new species.
Pile of mesonotum yellow or golden...................................... 27.

27. Scutellum with four bristles; pile of frons and mesonotum pale yellowish; occipital bristles yellow.................................... **variegata** Loew.
Scutellum with two bristles; post-ocular bristles black; pile of thorax and frons largely golden yellow.................. **variegata flavipilosa**, new subspecies.

28. Broad posterior margin of second, third, and fourth abdominal segments gray pollinose, fifth except narrow base and all of sixth; upper frons gray brown pollinose; western species.............................. **limata** Coquillett.
Posterior angles of second, third, fourth, and sixth abdominal segments gray pollinose, fifth almost wholly so; upper frons thinly blackish brown pollinose; boreal species.. **canadensis**, new species.

The HAEMORRHOIDALIS group.

There is a definite group in the genus *Psilocephala* which might be called the *haemorrhoidalis* group; it has several widespread species which closely resemble one another, the females of some being separated by minute differences. The male abdomen is short, flattened above, and densely silvery pollinose; the male genitalia are of the same general type. The antennae are of the same structure and general shape. The frons of the female has a large shining black callosity which fills nearly the whole space between the eyes.

PSILOCEPHALA HAEMORRHOIDALIS (Macquart).

Plate 6, figs 47 and 48; plate 13, figs. 171 and 172.

1840. *Thereva haemorrhoidalis* MACQUART, Dipt. Exot., vol. 2, p. 26.

There has been some discussion as to what species Macquart was describing, as there are several species which might answer the description. The writer has designated the form most common in the type locality, a species having a wide distribution over the Eastern States. Kröber had no clear idea of the species, as he placed several forms under that name in the United States National Museum material; he intimates that *P. haemorrhoidalis* may turn out to be a synonym of *Thereva nigra* Say, and in his paper on the North American Therevidae writes the following:

> In the Wiener collection there are before me specimens (females) of *Thereva nigra* Say (which belonged to the Wiedemann collection and also bear his determination), which seem to belong to the above species (*P. haemorrhoidalis*). They are true *Psilocephalae*, with bare face but thickly pilose palpi. If it is determined that *Thereva nigra* Say is a *Psilocephala* species, then must *P. haemorrhoidalis* be made a synonym of it. Coquillett wrote that *Thereva nigra* was a true *Thereva*.

Larva.—Malloch gives a description of the larva[9] and figures both larva and pupa in the same publication. The larva is probably not distinguishable from the larva of *P. frontalis* new species.

Pupa.—The rows of spines and thorns on the abdominal segments are arranged in a characteristic fashion, the other structures being about the same as in *P. frontalis*. The first abdominal segment has six evenly spaced slender spines across the middle of the dorsum; segments two to six have two short yellow spines on each side of the median line and on each side of this short and long spines (see figs. 171 and 172); on the seventh segment the spines are long and curved. Along the sides of the abdomen there are raised tubercles above the spiracles and below these a group of four slender spines.

Type locality.—"Carolina."

Type.—Presumably in the Museum of Lille, France.

Below is given a description of what is considered to be this species:

Male.—Length 6 to 7 mm. Black, almost entirely white pilose; frontal triangle silvery on the sides, with a narrow central wedge of shining black (fig. 48); the ocellar tubercle gray pollinose. Face silvery white pollinose, a few short black hairs on each side of the median black frontal stripe. Antennae black, rather slender, the third joint a little longer than first and slightly wider in the middle; first and second joint and base of third with black bristles. Palpi brown with long white pile; post-ocular bristles black; cheeks with a black spot below the eye on which there is short black pile; cheeks and occiput white pilose; occiput gray pollinose above and white below.

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[9] Bull. Ill. State Lab. of Nat. Hist., vol. 11, art. 4, p. 334.

Thorax black, more or less shining on sides of mesonotum, the dorsum bluish gray pollinose; a median black stripe, narrowed at the anterior and posterior ends; on each side of the median stripe a narrow, faint whitish stripe. Pile on the margins of the mesonotum white, brownish black on the central part of the dorsum. Scutellum gray pollinose, white on the posterior margin, with four black bristles and short white pile. Pleura except a large part of pteropleura dense silvery white pollinose, the pile white; very long pile before the halteres. Knob of the halteres blackish, the stem yellowish.

Abdomen black, largely gray or silvery gray pollinose, most of the dorsum bare of pile; the second to sixth segments silvery tomentose, bright in certain lights; a shining black spot on the sides of the second, third, and fourth segments near the base. Pile of the abdomen white, longer at the base, reclinate on the dorsum. The seventh segment scarcely visible in most specimens; genitalia reddish and yellow, with a few short yellow hairs, but mostly scattered long black pile. Femora black, appressed silvery white pilose, with some longer erect white pile below and behind on the two front pair; base of front tibiae and first tarsal joint yellowish, the rest black; on two hind pair of legs the tibiae and first two tarsal joints yellow except the blackish tips the other tarsal joints black; bristles of legs black. Wings hyaline, the stigma brown, the veins yellow at the base and in the costal region, otherwise brown; a pale brown spot at the outer side of the cell first M-2; cell M-3 closed and short petiolate.

Female.—Length about 7 mm. Closely resembling the male; bristles of first antennal joint shorter; frons shining black, slightly convex, smooth, the lower corners silvery pollinose (fig. 47), the vertex and ocellar tubercle gray pollinose.

Pile of mesonotum very short, black along the median line, on each side appressed yellowish; the lateral margins of the mesonotum short white pilose. Center of scutellum and the base black, the margin whitish pollinose; four black marginal bristles as in the male. Pile of pleura and coxae much shorter than in the male.

First segment of abdomen gray pollinose and white pilose, the rest of the abdomen shining black except the narrow posterior silvery margins of the second and third segments, the dorsum and sides of the fifth, and a silvery spot on the sides of the sixth. The pile of the first three segments short, reclinate, and white, on the other segments short, erect black. Wings as in the male; often with a faint clouding of brown or gray in the tip of the wing.

Distribution.—The distribution according to 35 males and 55 females examined is:

New Jersey: Westville, August 14 [U.S.N.M.]; Anglesea, May 28 (Daecke); Lucaston, September 3 (Daecke); Riverton, June 15 to August 9 (Daecke and Johnson), [all C. W. Johnson].

New York: Rochester, June 24 to July 24 (M. D. Leonard); Honeoye Falls, June 16 (M. D. Leonard), [all Cornell]; Sea Cliff, Long Island (Banks), [Cole]; Bergen Island, July 20 (Zabriskie), and Flatbush, September 16 (Zabriskie), [both Amer. Mus.]; Batavia, July 20 [Minn.].

Maryland: Hancock, May 29 (Cole), [Cole]; Plummer Island, July 31 (R. C. Shannon) and July 9, "at light" (H. S. Barber), [both U.S.N.M.].

Pennsylvania: Alleghany County [Carnegie Mus.]; Lehigh Gap, July 11 [Cole]; "Penn." [U.S.N.M.]; Pittsburgh, July 23 (H. Kahl); Heckton Mills, June 15 (W. R. Walton); Castle Rock, Delaware County, June 17 (Daecke); Harrisburg, May 30 to August 16; Brandtville, July 14 (H. B. Kirk), [all Harrisb. coll.].

District of Columbia: No other data (Loew), [M. C. Z.].

North Carolina: "N. C." [U.S.N.M.]; Southern Pines, September 16 (A. H. Manee), [J. S. Hine]; Black Mountains, June [Amer. Mus.].

Alabama: Pickett Springs, Montgomery County, August 5 [Amer. Mus.].

Louisiana: Opelousas, May [Cole].

Ohio: Sandusky, Cedar Point, May 30 to July 14 (Hine); Columbus, 1896 (Hine); Hinckley, Medina County, August 17 (Hine); Lakeside, Ottawa County, August 2 (Hine), [all J. S. Hine].

Illinois: Chicago (W. M. Wheeler), [Amer. Mus.].

Michigan: Agricultural College, July 25 and August 10 [Cornell]; one specimen with no data, determined by Osten Sacken [M. C. Z.].

Kansas: Clay County (Hine), [J. S. Hine]; Johnson, Chautauqua, Linn, Montgomery, Cowley, and Sedgwick Counties (all R. H. Beamer), [all Kans. U.].

Missouri: Two miles west St. Louis, June 4 (W. V. Warner), [U.S.N.M.].

Texas: Waco (Belfrage), the specimen figured in Howard's Insect Book [U.S.N.M.]; no other data, September (Loew), [M. C. Z.]; College Station, June 4 (H. J. Reinhard), [Cole].

PSILOCEPHALA FRONTALIS, new species.

Plate 6, fig. 43; plate 13, figs. 168, 169, and 170.

This species has been placed with *haemorrhoidalis* in many collections and is very nearly like that species. There is no constant difference in size.

The male is distinguished from *haemorrhoidalis* by having more of the frontal triangle shining black, the black running to the base of the antennae. On the male genitalia there are two clumps of short black spines at the tip of the hypandrium, one on each plate (fig. 2); the rest of the pile is pale yellowish or whitish and not largely black as in *haemorrhoidalis;* thus the two tufts of black bristles are very noticeable. As far as can be made out at present, the female is to be distinguished only by the difference in the extent of the silvery pollen on the frons, there being no silvery triangles on the lower corners of the frons, which in *haemorrhoidalis* reach up beyond the base of the antennae (fig. 43). These differences are slight but constant and do not break down in any of the series examined. The two species overlap in their distribution over the Eastern States, but *frontalis* spreads much farther north and west. All of the Canadian specimens examined belong to this species and not to the true *haemorrhoidalis.*

Larva.—About 25 mm. in length and very slender, not more than 1.25 mm. wide at the thickest portion. White; the head small and dark brown. On the specimen there are no visible hairs on the head, but these have probably been rubbed off, as there are small marks resembling scars, situated much as in *P. haemorrhoidalis*, and the stigmatical spot is the same as in that species. The spiracles show plainly on the sides of nine of the abdominal segments, the last segment ending in two small styliform bodies as usual. On most of the abdominal segments there are peculiar markings caused by curved rows of small round indentations, which are branched in a more or less characteristic manner. (Fig. 169.)

Pupa.—The pupa is much like those of other known species of *Psilocephala* and *Thereva.* The arrangement of spines and tubercles does not seem to vary a great deal in the species examined. The general color is yellowish. Length about 9 mm. The two thorns on the head are quite long and sharply curved. (Fig. 170.)

Type locality.—Holotype, male, and allotype, female, collected at Rochester, New York, July 4 and 24, 1914 (M. D. Leonard).

Types.—In the Cornell University collection.

Paratypes.—Male and female, No. 25930, U.S.N.M.

Distribution.—Distribution according to 48 male and 72 female paratypes:

Canada: Maniwak, Quebec, July 12; Montreal, August 11 (Beaulieu); Ottawa, Ontario, July 20 to August 14 (Beaulieu); Belleville, Ontario; Ottawa, Ontario, July 16 (A. Gibson); Ottawa, Ontario, June 26; Ottawa, Ontario, July 3 and August 7 (W. Metcalfe), [all Canad. coll.]; Jordan, Ontario, July 10 and 20 (H. Curran), [Cole]; Toronto, Ontario, July 18 (C. W. Johnson), [Cole]; Ontario, July 21 (Evans), at light [Canad. coll.]; Burlington, Ontario, June (H. C. Huckett), [Cornell].

Maine: Kennebunkport, July (G. H. Clapp), [U.S.N.M.].

Connecticut: New Haven, June 30 (H. B. Kirk), [Harrisb. coll.]; "Conn." (Williston), [Kansas U.]; East River, July 11 (C. R. Ely), bred from borings in rotton apple wood [U.S.N.M.].

Massachusetts: "Mass." [Kans. U.]; Tyngsboro (F. Blanchard), [M. C. Z.]; Boston, July (C. W. Johnson), [Cole]; Woods Hole, August 25 (W. M. Wheeler), [Amer. Mus.]; Springfield (G. Dimmock), [U.S.N.M.]; Melrose Highlands, June 22 (D. H. Clemons); Tyngsboro (Riley); Nantucket Island, August 27 (Riley), [all U.S.N.M.]; Auburndale, August 13 [B. S. N. H.]; Marthas Vineyard, July 17 [B. S. N. H.]

Vermont: Rutland, August 8 [B. S. N. H.].

New Jersey: Jamesburg, July 4 [C. W. Johnson]; Newark, June 16 [C. W. Johnson]; Jamesburg [Amer. Mus.].

New York: Fishers Island, August 19 (Zabriskie), [Amer. Mus.]; Rochester, July 11 to 15 (M. D. Leonard), [Cornell]; Oswego, July 17 [C. W. Johnson].

Pennsylvania: "Pa." [Kans. U.]; Jeanette; Pittsburgh; Westmoreland County, July; Dauphin, July 14 [all Harrisb. coll.].

Indiana: Whiting, July 13 (W. M. Wheeler), [Amer. Mus.]; Wolf Lake, July 14 (W. M. Wheeler), [Amer. Mus.].

Ohio: No other data (Leow), [M. C. Z.].

Illinois: "Illinois" (H. Edwards); Chicago, June 16 to July 20 (W. M. Wheeler), [Amer. Mus.].

Michigan: Agricultural College, July 3 to 25 [Cornell]; Whitmore Lake, July 3 (E. G. Anderson), and Ann Arbor, July 25 (E. G. Anderson), [R. C. Shannon].

Wisconsin: Polk County (Baker), [Stanford]; Milwaukee, June 26 (W. M. Wheeler); Rochester, July 25 (W. M. Wheeler), [Amer. Mus.].

Minnesota: Olmsted County, June 24 and July 27 (C. N. Ainslee); Pipestone County, July 1; Big Stone County, July 25; Chicago County, July 16; Washington County, July 21; St. Anthony Park, June 29 [all Minn.].

Nebraska: "Neb." (Loew), [M. C. Z.]; Lincoln, July 21 to August 2 (C. C. Bradbury), [Cornell]; Lincoln, July (Riley), [U.S.N.M.].

South Dakota: Pierre [Stanford].

Wyoming: "Wyo." [U.S.N.M.].

Kansas: Onaga, July 27 (Hine); Clay County (Hine), [Hine]; Onaga (Crevecour), [U.S.N.M.]; Chautauqua County (Beamer); Gove County, June (Bailey), [Kans. U.].

Louisiana: New Orleans (Shufeldt), [U.S.N.M.].

PSILOCEPHALA FLAVIPENNIS, new species.

Plate 6, fig. 41; plate 7, fig. 69; and plate 8, fig. 107.

Male.—In general appearance much like *haemorrhoidalis* and in some respects like *aldrichi*, with which species it has been confounded.

Frons shining black, silvery pollinose on the lower corners. Antennae black, the third joint slightly longer and wider than the first.

The dorsum of the thorax lacks the distinct, dark, median thoracic stripe; pile of the dorsum reclinate and golden, very dense on the scutellum and the space in front of it. Pleura as in *haemorrhoidalis* and related species. Stem of halteres and base of knob brown, the rest of the knob yellowish brown (not bright yellow as in *aldrichi* or blackish as in *haemorrhoidalis*). Genitalia reddish, most all of the pile black (fig. 107 for structure). Wings yellowish hyaline, the veins yellowish brown; apex of the wing gray, the stigma yellow; cell M-3 closed. Legs as in *haemorrhoidalis*.

Female.—Distinguished from the female of *haemorrhoidalis* by the more apparent, short, tomentumlike golden pile on the thorax and scutellum, also by the pale-brown knobs of the halteres and the paler wing veins. The wings are darker than in the male, in some specimens with pale-brown infuscated areas; stigma yellowish. The frons is almost identical with *haemorrhoidalis* (fig. 17*c*), but the vertex and ocellar tubercle are shining instead of thinly gray pollinose.

Type locality.—Cupids Bower Island, Maryland, July 8 and 4, 1915 (R. C. Shannon).

Type.—Male, Cat. No. 25931, U.S.N.M.

Paratypes.—These consist of 11 males and 19 females, as follows:

Massachusetts: Woods Hole, July 18 (W. M. Wheeler), [Amer. Mus.]; Horseneck Beach, July 30 [B. S. N. H.].

Rhode Island: Buttonwoods, July 21 [B. S. N. H.].

New Jersey: Weymouth, August 16 (Daecke); Newbold, July 21 (Daecke); Stone Harbor, August 3 (Daecke); Lacy, July 22 (Daecke); Malaga, July 27 (Daecke), [all Harrisb. coll.]; Lakehurst, July 4 (C. E. Olsen); Clementon, August 8; Anglesea, September 1; Jamesburg, July 31 (C. W. Johnson), cotype of *P. aldrichi* Coquillett, Riverton, August 1 to 28 (C. W. Johnson), [all C. W. Johnson].

New York: "New York" [M. C. Z.].

Pennsylvania: Rockville, July 23 (Daecke), [Harrisb. coll.]; Natrona, July 30, and Philadelphia, July 22 [C. W. Johnson].

Virginia: Falls Church, July 17 and 25 (N. Banks), [Cole]; Falls Church, July 13 (Knab), [Biol. Surv.].

Maryland: Plummer Island, at light, August 3 (R. C. Shannon), [Cole]; Cupids Bower Island, July 8 (R. C. Shannon), [U. S. N. M.]; Plummer Island, July 14 to August 3 (R. C. Shannon), [Shannon].

PSILOCEPHALA NOTATA (Wiedemann).

Plate 7, fig. 75; and plate 8, fig. 85.

1821. *Thereva notata* WIEDEMANN, Dipt. Exot., p. 114.

This species is in the *haemorrhoidalis* group. The writer agrees with Mr. C. W. Johnson in his determination of this species, the

Florida specimens sent by him for examination answering the description very well.

Type locality.—Savannah, Georgia.

Type.—Presumably in the Westermann collection in the Zoological Museum, Copenhagen.

Male.—Length 7 mm. General body color black. The frontal triangle black in the center, silvery on the sides, flat and with a few short, black hairs. Face silvery pollinose; a black spot on the cheeks below the eye, clothed with short black pile; palpi brown, with white pile. Occiput gray pollinose above, silvery white below, with white pile; post-ocular bristles black. Antennae black, rather short and thick (fig. 85); first joint with black bristles; third joint about as long as the first and second and wider in the middle, the arista as long as the second joint.

Thorax black, shining on the sides, the mesonotum gray pollinose, with a faint indication of two white vittae and a darker central stripe. Dorsum with short tomentumlike golden yellow pile in the central part and erect black hairs, the margins with white pile. Scutellum black, gray pollinose and white pilose, with four black bristles on the margin. Pleura silvery gray pollinose and white pilose. Knob of the halteres blackish, the stem brown.

Abdomen black, largely silvery and gray pollinose and white pilose; sides of segments two, three, and four with a large shining black spot at base, the fifth segment with a smaller spot; the fifth, sixth, and seventh segments together about equal to the third. Dorsum of abdomen in certain lights intensely silvery. Genitalia reddish and black with mixed black and white hairs, the structure much the same as in *haemorrhoidalis*. Legs brownish yellow, darker at the ends of tarsi; silvery white reclinate pile on the femora, in addition to the erect white pile on the two front pair. Wings gray hyaline with a yellowish tinge; veins brown and yellow, the stigma pale brown, and a trace of a brown spot at the outer end of cell first M-2; cell M-3 closed and petiolate. (Fig. 75.)

Female.—Very nearly like the male, with the usual differences in this group. Frons and vertex, including the ocellar tubercle, shining black; the lower corners of frons silvery pollinose as in *haemorrhoidalis*. Bristles and hairs of antennae short and black.

Pile of the thorax much shorter than in the male, reclinate golden yellow and short erect black; a faint darker median stripe and an indication of two white vittae as in the male. Scutellum short reclinate golden yellow pilose.

Abdomen largely shining black; first segment faintly gray pollinose, with short erect white pile; second and third segments with distinct white posterior margins, bordered narrowly above by silvery gray pollen on which the pile is short, white, and reclinate; the rest of the abdominal pile, above and below, short and black, erect beyond the third segment; silvery pollen on the sides and posterior margins of fifth and sixth segments. Legs and wings as in the male.

Distribution.—The four males and one female examined were from the following localities in Florida: Daytona, April 8 (C. W. Johnson); St. Augustine, March 13 (C. W. Johnson); Ormond (Mrs. A. T. Slosson), [all Cole]; Atlantic Beach, the pair described above (Mrs. Slosson), [U.S.N.M.].

Kröber gave Pennsylvania as an additional record in his paper on the North American Therevidae, but this record is doubtful.

PSILOCEPHALA ARIZONENSIS, new species.

Plate 6, fig. 58.

This species is in the *haemorrhoidalis* group and near *notata* Wiedemann, but has yellow antennae and black femora.

Male.—Length 6 mm. Frontal triangle dull-gray pollinose, with a few black hairs on the lower portion; lower corners of the frons and the face silvery gray pollinose. First two antennal joints dull yellow, with black bristles; first joint slender (third joint missing). Ocellar tubercle gray pollinose and with black pile. The mouth parts black, with white pile. Cheeks dull black just below the eye, with short black pile on this dark spot. Occiput silvery gray pollinose and white pilose.

Thorax black, gray pollinose, thinly so on the lateral margins; largely dark-brown erect pilose, with some reclinate yellow pile and a few erect white hairs. A median dark-brown vitta is present as in *haemorrhoidalis*, and on either side a whitish vitta. Scutellum gray pollinose and white pilose, with four black marginal bristles. Pleura and coxae as in the other species of the *haemorrhoidalis* group. Knobs of the halteres blackish brown, the stems yellowish brown.

Abdomen black, the first segment gray pollinose except for a small posterior angle; dorsum of second to sixth segments dense silvery pollinose and white pilose; lateral margins of second, third, and fourth segments largely shining black; venter silvery gray pollinose and white pilose. Genitalia yellow, largely yellowish pilose; some black pile on the genitalia and sixth segment. Femora and most of tarsi black; the knees, tibiae, except apices, and base of tarsi yellowish red. Wings hyaline, veins yellow at the base, brown beyond the basal half, the stigma brown; a brown spot outside the small cross vein, curving around the outer end of cell first M-2; cell M-3 closed and petiolate.

Female.—Length 8 mm. Very nearly like the female of *notata*, but differing in the coloring of the antennae and the legs. The shining black callosity of the frons quite convex and reaching to the ocellar tubercle (fig. 58); ocellar tubercle and vertex gray pollinose. A few short black hairs on the upper third of the frons and just above the antennae.

Thorax and legs as in the male, the pile on the dorsum of the thorax shorter, the reclinate yellow pile more noticeable. Halteres blackish brown. Spot at end of cell first M-2 very faint. Abdomen shining blackish brown, the first segment largely gray pollinose, a silvery spot on the posterior angles of second and fifth segments; posterior margin of second and third segments white, above the white on the second segment a narrow border of silvery pollen.

Type locality.—Chiricahua Mountains, Arizona, May 30 (H. G. Hubbard).

Type.—Male, Cat. No. 25932, U.S.N.M.

The types are rather imperfect specimens. There are two female paratypes in the collection of the California Academy of Sciences, taken June 20, 1916, in Mormon Canyon, Arizona. In both of these, as in the types, the third antennal joint is missing. The unusual yellow color of the first two antennal joints will easily distinguish the species.

PSILOCEPHALA JOHNSONI Coquillett.

1893. *Psilocephala johnsoni* COQUILLETT, Can. Ent., vol. 25, p. 228.

The type is a unique female, in C. W. Johnson's collection. A female loaned for study by Mr. Johnson seems to be scarcely distinguishable from *P. notata* Wied. It is reported from St. Augustine and Ormond, Florida, in Aldrich's catalogue.

Type locality.—"Florida."

PSILOCEPHALA UNIVITTATA Bellardi.

1861. *Psilocephala univittata* BELLARDI, Saggio di Ditter. Messic., vol. 2, p. 90.

I have translated the original description, which is fairly complete, and from which the following notes are given:

> *Female.*—Front bare, black, shining, on sides at base whitish gray pollinose; antennae black; occiput gray, gray pollinose; thorax black, longitudinally obsolete gray quadrivittate; halteres black.
>
> Abdomen long, almost bare, black, shining; fifth segment obsolete gray pollinose. Femora black; tibiae and tarsi brown. Wings yellowish hyaline; veins faintly margined brown. Length 9 mm.

These are the most important parts of the description.

Type locality.—Puebla, Mexico.

Type.—Said to be in the collections of Saussure, Bigot, and Bellardi. The Bigot collection is now owned by J. F. Collin, Newmarket, England, and Bellardi's is in Turin, Italy.

Distribution.—Williston records this species in the Biologia Centrali America (vol. 1, p. 297) from specimens taken at Xucumanatlan, Amula, and Omilteme, all in Guerrero, Mexico, and was doubtful whether the species was distinct from *notata* Wiedemann.

A male from Omilteme and one from Amula were loaned from the collection of the American Museum, and they seemed to represent a distinct species, much closer to *haemorrhoidalis* than to any other species; whether they are the true *univittata* or not it would be difficult to say, because of the many closely related species in this group.

PSILOCEPHALA SIGNATIPENNIS, new species.

Plate 8, figs. 93 and 103.

Male.—Length 6 to 7.5 mm. Head black; the face, a rim next to eye, cheeks, and lower corners of frontal triangle silvery white pollinose; most of the frons shining black and erect black pilose. Pile of occiput and palpi white; cheeks with short black hairs on a black spot below the eye; occiput semishining grayish black, with black bristles. Antennae black, more or less gray pollinose, especially the first two joints which are black bristled; a noticeable group of short black bristles at base of third joint. (Fig. 93.)

Thorax black, the large median portion gray pollinose, the sides and three narrow dorsal stripes semishining; pile of the dorsum erect and black. Scutellum black, semishining, the tip whitish, with four black bristles. Pleura black, the pteropleura shining, the rest and the coxae silvery gray pollinose and white pilose. Halteres entirely black.

Abdomen black, the dorsum of second to sixth segments shining silvery pollinose with sparse, fine white pile; first segment gray pollinose with rather long white pile at the sides; the lateral margins of the first, third, and fourth segments shining black, also the anterior part of the second and the venter, except faint gray pollen on the first two segments; pile of abdomen largely white, some black below on the sixth segment and on the genitalia. Genitalia mostly concealed in the last abdominal segment, brown and yellow in color with yellow pile above. (Fig. 103.) Legs in most specimens entirely black, femora with most of pile silvery white and erect; front femora with three black bristles inside and below. Wings whitish hyaline, stigma black, apex of wing usually gray, and a large brownish gray spot near the end of cell first M-2 which varies somewhat in size; cell M-3 closed near the margin.

Female.—Nearly like the male. Frons shining black and nearly the same as in the female of *platancala;* a small round depression just above and between and antennae and a depressed line above this. Cheeks below the eye dull black.

Mesonotum with very short reclinate black pile. Abdomen shining black, short reclinate black pilose on the first, second, and third segments, the rest of the abdomen and the genitalia short erect black pilose; the narrow posterior margin and the posterior corners of second segment silvery white; white pile on the silvery parts and on the lateral margins of first segment; a silvery spot on each side of the fifth segment. The apical gray-brown marking in the wing more extended.

Type locality.—Hood River, Oregon, July 3, 1917, on strawberry plants (F. R. Cole).

Type.—Male, Cat. No. 25933, U.S.N.M.

What appears to be a variety of this species occurs in southern California. The front tibiae are brown at the base and the others largely yellowish; the basal joints of the tarsi are more or less yellowish. The central wing spot is much reduced and the apical spot missing. The species is very close to *platancala* Loew.

Paratype.—There are 10 males and 18 females, distributed as follows:

Oregon: Hood River, July 3 (Cole), [Cole].

California: Los Angeles, April 29 (M. C. Van Duzee), [C. W. Johnson]; Colton, May 26 (E. P. Van Duzee); South Fork, Kings River Canyon, altitude 5,000 feet, Fresno County, July 4 (E. C. Van Dyke); Sobre Vista, Sonoma County, May 8 (J. A. Kusche); El Cajon, San Diego County, April 28 (E. P. Van Duzee); Shasta Springs, June 13 (C. L. Fox), [all Cal. Acad. Sci.]; Compton, April 15 (Cole); Redlands, May and June (Cole), [Cole].

PSILOCEPHALA PLATANCALA Loew.

Plate 6, fig. 44; plate 7, fig. 76; and plate 8, fig. 90.

1876. *Psilocephala platancala* LOEW, Zeitschr. Ges. Naturwiss., new ser., vol. 14, p. 321.

Female.—Length 8 to 9 mm. Black, partly gray pollinose. Vertex gray pollinose and a very narrow margin of frons next the eye. Face silvery pollinose; frons shining black, the shining portion reaching slightly beyond the base of the antennae. (Fig. 44.) Antennae black, third joint slightly longer than the first and slightly broader, all the antennal joints gray pollinose. A few minute black hairs just above the antennae. Palpi black or blackish brown, with black pile. Occiput gray pollinose, the pile below white.

Thorax and scutellum black, the mesonotum, pleura, and scutellum gray pollinose; sides of mesonotum thinly pollinose or semishining, the pollen of pleura silvery gray. A very faint median brownish stripe on mesonotum. Scutellum with four black bristles. Knob of halteres black, the stem blackish brown.

Abdomen almost wholly shining black, first segment and base of second thinly gray pollinose; posterior margin of second and a very thin line on posterior margin of third sternite silvery gray pollinose;

a silvery gray pollinose spot on sides of fifth segment. Base of abdomen with a few whitish pile, the rest of abdominal pile short and black. First two tergites thinly gray pollinose, posterior margin of the second white, the rest of venter shining black. Front legs black except reddish color at base of tibiae; all femora black, the four hind tibiae and metatarsi reddish yellow with blackish tips, second tarsal joint yellow basally, the last three joints blackish. Wings faintly infuscated and with a yellowish tinge, the apex and margins of veins in apical half of wing darker (fig. 76); stigma brown; a hyaline spot at base of cell R–1 and subcostal cell; wing veins brown, yellowish toward the base.

Male.—Length 7 mm. Smaller than female and with more gray pollen on the body. Frontal triangle shining black, narrowly silvery on the sides, with numerous black hairs, in some specimens as long as the first antennal joint.

Thorax and scutellum entirely gray pollinose, thinly so on the sides of mesonotum so that the shining black shows through; pile rather long, erect, whitish, and pale brownish. Pteropleura semishinning, the other pleura densely gray pollinose. Halteres blackish brown, the knobs large.

Dorsum of abdomen densely silvery pollinose, reclinate white pilose above, longer and erect on the sides and venter; the sides of segments two to five shinning black at the base; venter on first three segments gray pollinose, the base of second shining, fourth to seventh semishining, thinly pollinose; sixth segment about four-fifths as long as the fifth, the seventh very short, it and the genitalia rather long black pilose. The genitalia has some short yellowish pile, is reddish in color, and covered largely by last segments of abdomen.

Type locality.—Texas.

Type.—In the Museum of Comparative Zoology at Cambridge, Massachusetts.

Distribution.—The distribution according to 12 males and 10 females examined is:

Pennsylvania: North Mountain, June 8 [C. W. Johnson].

Kansas: Morton County (F. H. Snow), [Kans. U.].

Texas: El Paso, July 23 (J. C. Bradley), [Cole].

Colorado: Fort Collins, August 3 [C. W. Johnson]; Denver, July 26 (E. C. Jackson), [Biol. Surv.]; a series with no other data, determinded by Kröber as *haemorrhoidalis* [U.S.N.M.]; Boulder, June 21 (T. D. A. Cockerell); Rocky Ford, August 28, "bred with *Loxostege*" [both Cole].

Arizona: Tuscon (F. H. Snow); Douglas, August (F. H. Snow), [both Kans. U.].

PSILOCEPHALA COSTALIS Loew.

Plate 6, fig. 63; plate 7, fig. 74; and plate 8, fig. 99.

1869. *Psilocephala costalis* LOEW, Berl. Ent. Zeitschr., vol. 13, p. 11.

Male.—Length 5 to 6 mm. Closely resembling *P. signatipennis* and *platancala*, yet differing distinctly from any of the species in the *haemorrhoidalis* group. Frontal triangle shining black in the middle, but not so widely so as in *signatipennis* and with a few short black pile. First antennal joint gray pollinose and almost as long as the third, with black bristles and pile; some of the bristles half as long as the first joint. Occiput largely shining black, the eye margins gray pollinose. Pile on the lower part of the head white, except the short black pile on the usual black spot below the eye. The mesonotum is largely shining black, the median shining stripe very broad; on either side a broad gray pollinose stripe which reaches to the scutellum. Pile of mesonotum fine, erect, and blackish, in some specimens with considerable white pile intermixed. Scutellum black, gray pollinose on the posterior margin, white pilose, and with four black marginal bristles. Pleura and coxae black, gray pollinose and white pilose. Halteres blackish, the stem brownish at the base. Abdomen shining black; dorsum of the second to the fifth segments dense silvery pollinose, the pile white, reclinate above, longer and more erect on the sides and venter. External genitalia small (fig. 99), black, the pile largely black; some of the internal structures reddish. Second abdominal segment with a white posterior border above and below. The venter and sides of the segments shining black. Legs usually entirely black, occasionally with the bases of the four hind tibiae and tarsi dark reddish. Pile of the femora white. Front tibiae and tarsi slightly swollen, the first tarsal joint shorter and thicker than on the hind legs. Wings with a faint dark spot in the base of cell R-5, the costal and marginal cells and stigma blackish brown, the wings otherwise hyaline. (Fig. 74.)

Female.—Length 6 to 7 mm. Closely resembling the male. Frons shining black except for the lower corners (fig. 63) and slightly convex; the ocellar tubercle shining black. Pile of mesonotum very short and sparse, blackish in color. Superimposed on the broad gray vittae are two narrow white stripes near the inner edges of the gray. Posterior margin of the scutellum dense silvery gray pollinose. Abdomen largely shining black; the white posterior border on the second segment quite broad and with a line of silvery gray pollen lying anterior to it; sides of the fifth segment with a silvery gray spot. Pile of the abdomen very sparse, whitish on the basal two segments and black on the remaining segments. The apical half of the wing is more or less clouded, more strongly so along the veins.

Type locality.—California.

Type.—In the Museum of Comparative Zoology at Cambridge.

Distribution.—The distribution according to six males and eight females examined is as follows:

Washington: Wenass Valley, Pressey's, July 6, 1882 [M. C. Z.].

Nevada: Ormsby County, July 6 (C. F. Baker), [Stanford Univ.].

California: Santa Paula [Cornell]; no data (Osten Sacken), [M. C. Z.]; San Diego, April 19 (F. E. Blaisdell); Sisson, July 25 (E. P. Van Duzee), [both Cal. Acad. Sci.]; mountains near Claremont (C. F. Baker); Claremont (C. F. Baker); Laguna Beach (C. F. Baker), [all Pomona College]; Concord, August 23 (M. C. Lane),[Cole]; Santa Clara (Harkins), [Stanford Univ.].

PSILOCEPHALA ARGENTATA (Bellardi).

1861. *Thereva argentata* BELLARDI, Saggio di Ditterol. Messic., vol. 2, p. 90.

From the fairly comprehensive original description one would judge that this species is very close if not identical with *P. platancala* Loew. Williston redescribed the species from a male taken at St. Vincent, West Indies, and gave a poor figure of the antenna. Bellardi stated that the species was related to *Thereva anilis* of Europe, but this species is now placed in the genus *Dialineura.*

Type locality.—Cordoba, Mexico.

Types.—When described the types were in the collections of Bellardi and Saussure. Bellardi's collection is in Turin, Italy.

PSILOCEPHALA NIGRIMANA Kröber.

1912. *Psilocephala nigrimana* KRÖBER, Stett. Ent. Zeit., p. 238.

From the description this would appear to be the same as *platancala,* and it comes from a locality where one would expect to find *platancala.* But Kröber determined a series of *platancala* sent to him from the National Museum as *haemorrhoidalis.* A specimen collected at Claremont, California, and loaned by the National Museum for study, was determined by Kröber as *Psilocephala* near *nigrimana;* the specimen is a paratype of *signatipennis* described above. Collecting in the type locality will eventually determine the status of the species.

Type locality.—Pueblo, Colorado.

Type.—In the Hofmuseum in Vienna.

PSILOCEPHALA ALDRICHI Coquillett.

Plate 5, figs. 38 and 39; and plate 6, fig. 42.

1893. *Psilocephala aldrichi* COQUILLETT, Can. Ent., vol. 25, p. 227.

There has been some confusion as to the identity of this species owing to the lumping of two distinct species by Coquillett. Mr. Johnson loaned the cotype of the form found in New Jersey, and it is quite distinct from western specimens; this eastern form has been given a new name, *flavipennis*. The color of the halteres is one of the characters differentiating the two forms; in the western form they are bright lemon yellow, in the eastern species pale brown. The cotypes in the National Museum are all of the western form, which has been designated as the true *aldrichi*. There seems to be a slight difference in the California and Northwestern specimens, and it is quite possible that Coquillett's original series will have to be split again when more specimens are studied from both localities.

The following notes are made from specimens taken in Oregon, Washington, Idaho, Montana, western Canada, and California:

Male.—A few minute black hairs on the frons above the antennae; cheeks dull black. In most specimens the thorax is very faintly pollinose, almost shining black; pile reclinate yellow and erect whitish or yellowish white, the two vittae very faintly perceptible, if at all. Base of the scutellum shining, the apical half whitish pollinose. Lateral margins of the abdominal segments beyond the first broadly shining black; second and third segments with white posterior borders; fifth, sixth, and seventh segments very short, the seventh scarcely visible. Genitalia reddish, with reddish yellow pile. The tibiae are reddish yellow with black apices.

Female.—Unusally 1 to 2 mm. longer than the male. Ocellar tubercle and usually a short strip on each side gray pollinose, but most of the frons shining black (fig. 42), much as in *P. frontalis* Lower occiput shining black except a white rim next to the eye. Thoracic vittae very distinct; pile of the thorax and scutellum yellowish, very short and sparse; pile before the halteres shorter than in the male. First abdominal segment with some gray pollen, the other segments shining black, with erect black pile beyond the third segment. Wings darker than in the male, with a yellowish gray tinge.

Type localities.—New Jersey, Montana, Wyoming, and California.

Cotypes.—Male and female, Cat. No. 10414, U.S.N.M.; others in C. W. Johnson's collection.

Distribution.—The following localities are given from a study of 26 males and 18 females.

Canada: Aweme, Manitoba, July 11 (Criddle), [A. N. S. P.]; Vancouver Island (H. Edwards), [Amer. Mus.].

Wyoming: Torrey's Lakes, September 7 [Amer. Mus.]; Niobrara County, August 22 (E. G. Holt), [Biol. Surv.].

Colorado: Denver, August (E. S. Tucker), Coq. det. [Kans. U.].

Montana: Gallatin County, July 18, elevation 5,500 feet, and August 15, elevation 6,000 feet; Missoula, August 17; Musselshell, August 17 [all Mont. Exp. Sta.].

Idaho: Boise, June 13 (Fisher), [Biol. Surv.]; Malad, June 20 (Cole), [Cole]; Lewiston (C. V. Piper), [R. C. Shannon].

Washington: Wapato, May 11 (Cole), [Cole]; Ritzville, June 12 to September 9; Sprague, June 20 and Medical Lake, July 14 (all R. C. Shannon), [Shannon].

Oregon: Forest Grove, July 12 (Cole); Hood River, June 20 (Cole), [both Cole].

California: Stanford University, May [Stanford U.]; Bradley, May 22 (E. P. Van Duzee); Berkeley, September 13; Sisson, July 24 (E. P. Van Duzee); Santa Rosa Island, May 20 (E. P. Van Duzee), [all Cal. Acad. Sci.]; Stanford University, May 20 (Cole); Perkins (W. B. Parker); sand dunes near Golden Gate Park, San Francisco, May 25 (Cole), [all Cole].

PSILOCEPHALA LAEVIGATA Loew.

Plate 6, fig. 55.

1876. *Psilocephala laevigata* LOEW, Zeitschr. f. d. Ges. Naturwiss, new ser., vol. 14, p. 319.

Type locality.—San Francisco, California.

The type is in the Museum of Comparative Zoology at Cambridge, Massachusetts.

This species is doubtfully separated from *aldrichi;* there are apparently constant though slight differences in the females, but the males are hard to distinguish. When larger collections are made of both sexes in certain localities the species can be straightened out. The females are distinguished from *aldrichi* by the darker wings and wing markings and by having the upper half of the frons gray pollinose. (Fig. 55.) There are no doubt slight differences in the male genitalia, but these are microscopic and largely internal, or obscured by the outer plates.

Distribution.—Two males and five females were examined, all from California.

There are four females in the Pomona College collection, collected at Claremont, California, by C. F. Baker; one female taken at Redlands, California, by the writer. The two males were taken, presumably, at about the same time as the four females, one specimen in the mountains near Claremont, California; no dates are given. More collecting around Claremont is necessary before describing the male of this species.

PSILOCEPHALA LATERALIS Adams.

Plate 6, fig. 62.

1904. *Psilocephala lateralis* ADAMS, Kans. U. Sci. Bull., vol. 2, p. 444.

Female.—Length 7.5 to 10.5 mm. Closely related to *laevigata*, the head much the same. Vertex gray pollinose; frons smooth, shining black, gently convex, the lower corners silvery white (fig. 62), face silvery pollinose. Antennae black, first two joints thinly gray pollinose, with a few black bristles; first joint about as long as the third and of nearly the same width. Cheeks black, with short black pile. Occiput silvery gray pollinose, white pilose, with black bristles.

Dorsum of thorax and scutellum densely silvery gray pollinose, sparse reclinate yellowish white pilose. In certain lights there is a brownish caste to the mesonotum. Broad lateral margins of the thorax and margin of scutellum shining black; scutellum with four marginal bristles. Pleura largely silvery gray pollinose, white pilose, the pteropleura semishining black Halteres bright yellow, the base of the stem light brown.

Abdomen shining black, first segment silvery gray pollinose, a narrow posterior rim on the second and third, and spots on the sides of the fifth silvery. Reclinate white pile on the first three segments, longer on the first; beyond the third segment short erect black pilose as usual. Venter gray pollinose on the first three segments. Fore legs black, also the four hind femora; the middle and hind tibiae reddish, darker at the tips; the middle and hind tarsi largely reddish, black apically; bristles of the legs black. Wing veins yellow and brown, the wing membrane yellow at the base, beyond this largely pale grayish brown; costal cell and stigma yellow; cells near the base of wing largely hyaline; cell M-3 closed near the wing margin.

Type locality.—Bill Williams Fork, Arizona.

Type.—In the Kansas University collection.

Distribution.—The distribution according to three females is: California—Compton; Los Banos, May 22 (E. P. Van Duzee), [Cal. Acad. Sci.]; Claremont (Baker), [Pomona College].

The writer first described the species as new, but Kröber's redescription of both sexes in his 1914 paper clearly places the species. It is near *aldrichi* and *laevigata*, and is recorded by Kröber from Death Valley, California, and Colorado.

PSILOCEPHALA MUNDA Loew.

Plate 6, fig. 46; plate 7, fig. 73; and plate 8, figs. 81 and 96.

1869. *Psilocephala munda* LOEW, Berlin. Ent. Zeit., vol. 12, p. 9.

1869. *Psilocephala melanoprocta* LOEW, male, described in the same publication, p. 11.

Male.—Length 7 to 8 mm. Head, including antennae, palpi, and proboscis, black. The antennae short, third joint longer than the first two combined and considerably wider, tapering and with a small style (fig. 73); strong bristles of first two antennal joints black. Occiput gray pollinose above, white below. Cheeks, occiput, and palpi white pilose, the vertex with black pile; face and large frontal triangle silvery white pollinose.

Thorax black, the mesonotum dull, gray-black with two narrow white vittae, lateral margins gray pollinose; pile erect, mixed black and white. Two pairs of praescutellar bristles and four bristles on the margin of the scutellum. Scutellum white pollinose and pilose. Pleura and coxae dense gray-white pollinose, with white pile, very long and thick before the halteres. Halteres blackish, the knob very large, somewhat paler on the sides, and faintly gray pollinose.

Abdomen black, densely silvery white pollinose and white pilose. Genitalia large and mostly shining black, the epiproct much longer than the hypandrium (fig. 96), sometimes reddish at the tip, with thick black pile, longer below. Femora black, with erect and also reclinate silvery white pile; basal half of tibiae and extreme base of tarsi yellowish brown, apical half of tibiae and most of tarsi blackish; fore tibiae with very little yellowish at the base; four front femora without bristles. Wings hyaline, the veins strong and black; stigma brown; cell M-3 closed near margin of wing. (Fig. 73.)

Female.—Much as in the male. Length 8.5 to 9.5 mm. About two-thirds of the frons shining black, more or less striated, the lower third silvery white pollinose (fig. 46); a few minute black hairs on the shining portion. First two antennal joints and base of third gray pollinose.

Thoracic vittae wider than in male, very conspicuous, fading into gray in front and before the scutellum; the white pile of thorax and scutellum less dense and confined to margins of mesonotum; the larger part short erect blackish brown pilose. Knobs of halteres appear white due to the covering of pollen; there is some yellowish color on the sides and gray beneath.

Abdomen largely shining black; sides of first and wide posterior margins of second, third, fifth, except a posterior triangle, and sides of sixth silvery white pollinose; seventh and eighth segments shining black. Pile at base of abdomen white, long at sides of first segment, beyond the fourth segment erect and black; venter mostly silvery white, darker toward the tip, the last two segments shining. Circlet of blunt spines on genitalia brown. Legs and wings as in the male.

Kröber was of the opinion that *melanoprocta* Loew was the male of *munda* Loew, and this has been proven beyond doubt in looking over several collections. The species has been reported from Pullman and Coupeville, Washington; Colorado; Wisconsin; Maine; New York; Montreal and Hudson Bay Territory, Canada.

Type locality.—Wisconsin (Kennicott).

Type.—In the Museum of Comparative Zoology at Cambridge, Massachusetts.

Distribution.—The distribution according to 35 males and 30 females is:

Canada: Montreal, Quebec, June [Kans. U.]; Ottawa, Ontario, August 29 (Beaulieu); Ottawa, May 25; Ottawa, August 26 (C. B. Hutchings); Sudbury, Ontario, June 22 to August 10; Cowley, Alberta, June 20 to 28 (R. N. Chrystal); Banff, Alberta, August 7 (N. B. Sanson); Prince Albert, Saskatchewan; Corcross, Yukon Territory, July 25 (A. P. Hawes); Kaslo, British Columbia [all Canad. coll.]; Vancouver, British Columbia, June 8; Cranbrook, British Columbia, July 26; Penticton, British Columbia, July 7 (E. M. Anderson), [all R. S. Sherman]; Fort Rae, Mackenzie, July 27 (E. R. Preble), [Biol. Surv.].

New York: North Elba, July [Amer. Mus.]; Ithaca, May; Adirondack Mountains, Axton, June 12 (A. D. MacGillvary), [Harrisb. coll.].

Pennsylvania: Rockville, May 10 [Harrisb. coll.].

Minnesota: St. Anthony Park, September 27 and July 18 [U. Minn.].

Michigan: Agricultural College, May 11 [Cornell].

Colorado: Manitou, August 18 (Osten Sacken), [M. C. Z.]; Denver, June 16 (J. S. Hine), [Hine].

Montana: Gallatin County, July 18; Judith Basin, June 6; Boseman, June 17 to July 3 [all Mont. Exp. Sta.].

Washington: Pullman, June 9 to August 2 (Cole); Molson, June 8 (A. C. Burrill), [Cole]; Forks, Clallam County, July 1 (E. P. Van Duzee), [Cal. Acad. Sci.].

Oregon: Multnomah Falls, September 30 (Cole), [Cole].

California: Muir Woods, May 9 (E. C. Van Dyke), [Cal. Acad. Sci.].

PSILOCEPHALA ARGENTIFRONS, new species.

Plate 6, fig. 64; plate 8, figs. 94 and 100; and plate 13, fig. 174.

Male.—Length 8.5 mm. Resembles *P. munda* in general appearance. Head black, the frons silvery gray pollinose, the upper corner of the triangle dull black. (Fig. 64.) Antennae rather short, the third joint longer than the first (fig. 94), black, with black bristles and pile; a few black hairs above each antenna. Face silvery white pollinose. Occiput, white pollinose and pilose. Proboscis and palpi black, white pilose; a few black hairs at the lower corner of the eye; bristles of occiput black and strong.

Mesonotum, pleura, and scutellum black, gray pollinose; two whitish gray longitudinal vittae on the dorsum of thorax, which is blackish gray, paler on the margins and before the scutellum; erect fine black pile in the median portion of the dorsum, white around the margins; pleura and coxae gray pollinose and white pilose; bristles of thorax black; middle of scutellum, space between thoracic vittae, and lateral margins of mesonotum semishining. Halteres blackish, the knob gray pollinose.

Abdomen black, silvery gray pollinose, the silvery white pile longer on the first three segments, shorter and reclinate on the fourth, fifth, and sixth; seventh segment and the genitalia black pilose; second segment with a white posterior margin. Genitalia blackish, the upper forceps much larger than the hypandrium. (Fig. 100.) Legs entirely black, the femora with silvery white pile, short and reclinate on the hind pair, on the front femora longer, more erect, and reaching only two-thirds of the way to the tip. Wings hyaline, the veins and stigma black; cell M-3 wide open.

Type locality.—Holotype, a male, bred out at Rockville, Pennsylvania, May 30, 1919 (A. B. Champlain).

Type.—In the Harrisburg collection, Pennsylvania Department of Agriculture.

This species may prove to be the same as *melampodia* Loew, of which the male is not known. The antennae are about the same as in *melampodia* and the legs and wings are alike.

Larva.—Length 26 mm. The larva of this species does not have the rows of indentations characteristic of *P. frontalis* and *P. haemorrhoidalis*. On the dorsum of the penultimate segment there is a group of four small hairs in the form of a square; on the venter two small hairs near the apex of the penultimate segment. The internal prolongation of the mouth parts can be seen through the semitransparent chitin. There is a large spiracle on the thorax as in the other known species of the genus. A single slender spine on each side of the three thoracic segments and a single spine on each side of the head.

Pupa.—About 14 mm. in length. Pale brownish in color. The thorns on top of the head are shorter than in *P. frontalis* and those at the base of the wing are smaller in proportion. The thorax is large and quite convex above. (Fig. 174.) The dorsum of the first abdominal segment has 6 bristles above, and there are 8 on the sixth and seventh segments; on the other segments the number of spines varies from 10 to 12. The venter of segments 2 to 6 has six spines, three on each side. The last segment ends in a bifid spine.

PSILOCEPHALA GRANDIS Johnson.

1902. *Psilocephala grandis* JOHNSON, Can. Ent., vol. 34, p. 24, female.

This form is very near *P. canadensis*, the following species, but is larger and has the frons marked differently. No other specimens of this species have been reported since the discovery of the unique type.

Type locality.—Rouville County, Province of Quebec, Canada.

Type.—In the collection of C. W. Johnson.

PSILOCEPHALA CANADENSIS, new species.

Plate 6, fig. 53.

Female.—Length 10 to 12 mm. A species very nearly answering the description of *grandis* Johnson, but smaller and lacking the diverging black lines on the frons (fig. 53); the upper two-thirds of the frons is dull-brown pollinose, in rubbed specimens showing dull black in the middle; this upper, narrower portion of the frons has numerous short black hairs. The antennae are short, nearly as in *limata*, black, thinly gray pollinose and with short black bristles on the first two joints. Lower half of frons and face silvery white pollinose. Pile of palpi and proboscis white. Occiput and cheeks whitish pollinose, lower half of occiput white pilose, as are the cheeks, the upper half with numerous black bristles.

Thorax black in ground color, gray pollinose, the dorsum with reclinate white pile and erect black pile; two distinct vittae and the lateral margins of mesonotum whitish gray, dividing the blackish gray dorsum into three parts. Scutellum black, thinly gray pollinose, more dense on the margin, with four black bristles. Pleura and coxae dense silvery gray pollinose, white pilose. Stem of halteres brown, base of the knob black, the outer portion whitish.

Abdomen black, shining, the first three segments white, reclinate pilose, longer on the sides of the first segment, beyond the third segment short erect black pilose as usual. First segment whitish gray pollinose on the sides; posterior angles of the second, third, fourth, all of fifth, and narrow lateral spots on sixth and seventh silvery gray pollinose; venter on first five segments silvery gray pollinose. Femora and apical joints of tarsi blackish; knees, tibiae except apices, and base of tarsi reddish; pile of femora white; all the leg bristles black. Wings with brown veins and stigma, the veins more or less faintly bordered brownish; cell M-3 wide open.

Type locality.—Trenton, Ontario, Canada, June 6, 1902 (Evans), [Canad. coll.].

Type.—Female, in the Canadian national collection at Ottawa.

There is a paratype in the Canadian collection taken at Ottawa, Ontario, June 3, 1912, and one female paratype in the collection of C. W. Johnson, taken at Montfort, Quebec, July 10, 1916. The species is related to *grandis* and *limata*, and would run to the latter species in Kröber's synoptic table. *P. limata* is a western species, is more densely pollinose, and the antennae are slightly different.

PSILOCEPHALA LIMATA Coquillett.

Plate 6, fig. 49; plate 7, fig. 71; plate 8, figs. 86 and 101; and plate 13, fig. 173.

1894. *Psilocephala limata* COQUILLETT, Journ. New York Ent. Soc., vol. 2, p. 99.

General body color black, gray pollinose, mostly white pilose; the tibiae largely reddish; wings hyaline.

Female.—Length 11 to 12 mm. Frons opaque brown pollinose and black pilose on the upper half (fig. 49), lower half and face bare and white pollinose; palpi brownish; pile beneath head, on cheeks, and on occiput white. Occiput gray pollinose, with black bristles. Antennae black, first joint gray pollinose, with black bristles, the third as long as the first and second combined and distinctly broader, the style about one-sixth as long as the third joint.

Thorax thickly dark gray pollinose, with two vittae and lateral margins light gray, the pile mixed black and white, the bristles black. Scutellum colored as thorax, with white pile and four marginal incurving black bristles. Pleura gray pollinose and white pilose, especially dense pile on the propleura. Stem of halteres yellowish, the knob largely yellowish but with a blackish base.

Abdomen black, first segment gray pollinose, second largely black, semishining, the posterior margin and sides gray pollinose, a narrow margin white; base of third, fourth, and fifth, and all of seventh segment shining black, the rest gray pollinose. First three segments with white pile, the last four with erect black pile as on the venter, which is wholly gray pollinose; genitalia black. Femora black, gray pollinose and white pilose; knees, basal two-thirds of front tibiae, three-fourths of hind tibiae, and bases of tarsi are yellowish brown. Wings hyaline, stigma pale brown; fourth posterior cell broadly open; wing veins dark brown.

Male.—Length 10 mm. Very nearly resembling the female. The eyes are contiguous for only a short distance, the frontal triangle large, silvery pollinose and with no sign of pile.

Vittae on mesonotum more definite than in the female and all the pile of thorax a little longer and more dense. In the two males examined there is a small, round, black spot at the base of the abdominal segments; the spot is near the middle and next the basal black border. Genitalia largely blackish and gray pollinose. All the pile of abdomen long and white, longer at the base; several black hairs beneath on the genitalia, the rest of the pile on the genitalia yellowish. (Fig. 101 for structure.) Legs almost entirely blackish in the typical specimen.

Pupa.—Length 12.5 mm. The color is yellowish; the thorns on the head and thorax rather short. Thorax not as highly arched as in *P. argentifrons;* beneath each spiracle along the sides of the abdomen there are two spines. First abdominal segment with six bristles above; there is a tendency to variation in the other rows of spines on the abdomen; on the last two segments there are 8 spines above and on the others from 10 to 12. On the venter of segments 2 to 7 there are 6 spines, 3 on each side, or at times 3 on one side and 4 on the other. The body ends in the usual bifid spine. (Fig. 173.)

Type localities.—Colorado and Washington.

Cotypes.—Females, No. 10419, U.S.N.M.

The neallotype male is in the collection of R. S. Sherman and was collected in the Hope Mountains, British Columbia, July 21, 1919 (Sherman).

The female listed below from Bear Valley, California, was bred from a pupa taken from an old pine log. The female from Colorado has the femora brownish and would not run to *limata* in Kröber's table of species.

Distribution.—The distribution according to two males and five females examined is:

Canada: Lillooet, British Columbia (A. W. Phair), [Canad. coll.]; Savary Island, British Columbia, July 12 (R. S. Sherman), [Sherman]; Vancouver, British Columbia, July (R. H. Chrystal), [Canad. coll.].

Colorado; El Paso County, July 12 (Champlain), [Harrisb. coll.].

California: Bear Valley, San Bernardino County, June (F. R. Cole), [Cole]; Fallen Leaf Lake, June 28 [Stanford Univ.].

PSILOCEPHALA MELAMPODIA Loew.

Plate 6, fig. 54; and plate 8, fig. 89.

1869. *Psilocephala melampodia* LOEW, Berlin. Ent. Zeitschr., vol. 13, p. 9.

The original description is of a female. The mesonotum is black, with two narrow vittae and the lateral margins whitish gray pollinose. The antennae are like those of *munda* Loew. (Fig. 89.) The frons is semishining black on the upper part. (Fig. 54). The legs are wholly black.

Type locality.—Illinois.

Type.—In the Museum of Comparative Zoology at Cambridge.

Distribution.—Three females were examined from the following localities: Boston, Massachusetts, June 27 (Allston), [B. S. N. H.]; Black Mountains, North Carolina, May [Amer Mus.].

PSILOCEPHALA VARIEGATA Loew.

1869. *Psilocephala variegata* LOEW, Berlin. Ent. Zeitschr., vol. 13, p. 170, male only.

Type locality.—"Canada."

Type.—In the Museum of Comparative Zoology, Cambridge.

The following notes are made from specimens examined by the writer:

Male.—The species seems unusually inclined to become greasy. The pile of the abdomen is not very dense, rather short, reclinate, white at the base, beyond the second segment yellowish, distinctly yellow on the hypopygium. The male genitalia are more nearly allied to *P. munda* in form than to any other species and are the same in the typical form as in the subspecies figured. The male specimen examined was 9 mm. in length.

Female.—Length 8.5 to 10.5 mm. Almost entirely whitish gray pollinose. Frons very broad, flattened, whitish gray pollinose, with a shallow impression in the central portion, in which some minute yellowish tomentumlike pile is visible; a few short black pile on the upper portion of the frons. Bristles of the occiput mixed yellow and brown. Antennae of about the same structure as in the male, the first two joints gray pollinose, with a few short yellow pile. From the antennae to the eye margin a dark-gray stripe as in *Dialineura*, species. Pile of the cheeks and occiput white.

Thorax with a broad, dark-gray median vitta, narrowed considerably toward the scutellum; on either side of the median stripe an elongate spot of the same color. Scutellum gray pollinose, with four marginal black bristles. Pile of the mesonotum and scutellum short, reclinate, yellowish. Pleura grayish white pollinose, some yellow pile above, the most of the pile white.

Abdomen on the first six segments largely whitish gray pollinose, a dull brown mark at the base of second and third, the base of the fourth very narrowly brown. Pile of the first three segments whitish, short, erect, and black on the other segments. The circlet of spines at the tip of the abdomen black. Wings and legs as in the male. Cell M-3 may be narrowly or broadly open in the margin of the wing.

Neallotype.—I have selected as a neallotype a female specimen collected at Fort Erie, Ontario, Canada, July 4, 1910 (M. C. Van Duzee), [Van Duzee].

A larger specimen was taken at Ridgeway, Ontario, June 18, 1911 by Mr. Van Duzee and s in the collection with the type. This specimen is more or less greased, and the markings not clear. In one wing of this specimen the cell M-3 is closed in the margin, in the other wing narrowly open. A specimen loaned by Mr. C. W. Johnson was collected at Oswego, New York, June 16, 1896, and is somewhat greased and faded, but typical of the species. The male specimen examined was taken at Ridgeway, Ontario, Canada, July 7, 1912 (M. C. Van Duzee), [Van Duzee].

PSILOCEPHALA VARIEGATA OCCIDENTALIS, new subspecies.

Plate 7, fig. 78, and plate 8, fig. 102.

Length 8 mm. Three male specimens collected in Oregon differ slightly from the typical form. The female of this form is not known. The male genitalia are externally of the same structure as in *variegata*, but the pile is black instead of yellow. Pile of the antennae and the post-ocular bristles black. Pile of head, thorax, coxae, femora, and abdomen rather short and silvery white. The scutellum has silvery pile and four black marginal bristles. The wing membrane is more gray than whitish.

Type locality.—Corvallis, Oregon, June 4,1897 (collector unknown).

Type.—Male, in the California Academy of Sciences.

Two male paratypes were examined, both taken by the writer at Hood River, Oregon, May 5, 1918; one of these is deposited in the National Museum (Cat. No. 25941).

PSILOCEPHALA VARIEGATA FLAVIPILOSA, new subspecies.

Plate 6, fig. 59, and plate 8, fig. 80.

Male.—Length 8 mm. Pile of the antennae black. Bristles of occiput black, the pile yellowish; pile of cheeks white. Tomentum-like pile of mesonotum and scutellum yellowish. Only the central pair of scutellar bristles present. Pile of the pleura and femora yellowish. There is a large basal brown spot on the dorsum of the second, third, and fourth abdominal segments, larger on the fourth. The abdominal pile is yellowish. External structure of the genitalia as in *variegata,* the pile, however, largely black; points of the hypandrium with a tuft of black pile. Cross veins and the fork of Rs distinctly clouded brown; cell M-3 narrowly open.

Female.—First joint of antennae unusually thick (fig. 80) as in the genus *Tabuda,* the bristles and pile black. Pollen of the broad frons yellowish, darker on the upper two-thirds and with short black pile. The mark from the base of the antennae to the eye very distinct. Pile of the head, including proboscis and palpi, yellowish. Face and occiput whitish pollinose. Central portion of mesonotum and base of scutellum with a brown tinge to the pollen, the pile tomentumlike and brassy yellow. Two scutellar bristles as in the male. Base of the second and third abdominal segments brown above, the fourth almost wholly brown, the sixth brownish, the last segment shining black. Pile of the first two segments and part of the third reclinate yellowish, otherwise short, erect black pilose. Pollen of the abdomen outside the dark spots yellowish white and not grayish white as in the typical *variegata.* Cell M-3 almost closed in the margin of the wing.

Type locality.—Collected at Paso Robles, California, April 26,1919 (E. P. Van Duzee).

Type.—One male, in the collection of the California Academy of Sciences; allotype, female, in same collection.

Only the two type specimens are known. Further collecting may show this to be a good species, as the two scutellar bristles and the very large first antennal joint may be constant characters.

PSILOCEPHALA FUSCIPENNIS, new species.

Plate 6, fig. 65.

Female.—Length 9 mm. This species is in most particulars very closely related to *P. variegata.* The antennae are as in *P. variegata,* but both pile and bristles are black. Lower third of frons silvery gray pollinose and bare of pile, the upper two-thirds darker and with a brownish tinge, with short black pile, very dense and unusually small in the central portion. (Fig. 65.) Bristles of occiput black.

Occiput, cheeks, and face whitish pollinose, with white pile. A dark streak from the base of the antennae to the eye margin as in *variegata*.

Mesonotum gray pollinose around the margins, the larger portion dark brown; a faint pale median vitta, very narrow, and two distinct but narrow gray vittae, one on either side of the central stripe. Most all of the pile of the mesonotum very short, reclinate, and black, so that to the naked eye the mesonotum appears blackish; some short reclinate yellowish pile around the margins. Scutellum gray pollinose, darker at the base, with reclinate yellow pile and four black marginal bristles. Pleura and coxae black, silvery gray pollinose, with white pile. The halteres largely blackish, the base of the stem yellowish.

Abdomen black, largely gray pollinose; a basal blackish brown triangular mark on the second and third segments, running to the posterior margin, fourth segment largely blackish brown above, seventh segment brownish gray, the eighth shining black. First two segments with reclinate yellowish pile, the other segments with short, erect black pile. Femora black, gray pollinose, short white pilose; base of front tibiae yellowish, the apical two-thirds, and the tarsi blackish; four hind tibiae on the basal two-thirds and the base of the first tarsal joint yellowish, the rest of the legs black. Wings largely brownish gray, the centers of the cells whitish hyaline; stigma black; veins yellowish near the base of wing, black beyond; cell M-3 wide open.

Type locality.—Forks, Clallam County, Washington, July 2 (E. P. Van Duzee).

Type.—Female, in the collection of the California Acadamy of Sciences.

This species is very nearly related to the western subspecies of *variegata*, but the male when collected will undoubtedly be found to have black pile on the thorax and differences in the genitalia.

PSILOCEPHALA LUGUBRIS (Macquart).

1840. *Thereva lugubris* MACQUART, Dipt. Exot., vol. 2, p. 24, pl. 5, fig. 2.
1861. *Psilocephala nigra* BELLARDI, Saggio di Ditter. Messic., vol. 2, p. 92.
1863. *Thereva morio* RONDANI, Archivo per la Zool., vol. 3, p. 44.
1868. *Psilocephala penthoptera* SCHINER, *Novara* Reise, Dipt., p. 146.
1912. *Psilocephala lugubris* KRÖBER, Stett. Ent. Zeit., vol. 73, p. 237.

The species is not known from north of Mexico. Kröber redescribes the species in his paper on the North American Therevidae from specimens taken in Chile, Bolivia, and Mexico. The frons in the female is shining black with two cross impressions. The wings are largely blackish brown.

Type locality.—Chile.

Type.—In Museum of Lille, France.

PSILOCEPHALA SLOSSONI Coquillett.

1893. *Psilocephala slossoni* COQUILLETT, Can. Ent., vol. 25, p. 227.

The type is a female. No other specimens have been collected. The frons is grayish brown pollinose, with two velvet black spots at its middle and near the eye margins. The femora and tibiae are yellowish.

Type locality.—New Hampshire (Mrs. A. T. Slosson).

Type.—In C. W. Johnson's collection.

PSILOCEPHALA PLACIDA Coquillett.

Plate 6, fig. 45.

1894. *Psilocephala placida* COQUILLETT, Journ. New York Ent. Soc., vol. 2, p. 99.

The type female, is the only specimen known. The halteres and antennae are yellow and there are no black spots on the frons. The length is given as 12 mm.

In material from the collection of the Pennsylvania Department of Agriculture there was one female specimen very near this species. The specimen was collected at Reedsville, Pennsylvania, May 31 (C. Anderson). It is the specimen illustrated (fig. 45).

Type locality.—Florida.

Type.—Female, No. 10420, U.S.N.M.

PSILOCEPHALA MONTIVAGA Coquillett.

1893. *Psilocephala montivaga* COQUILLETT, Can. Ent., vol. 25, p. 226.

In describing the species Coquillett had one male and two females, taken in Los Angeles County, California. It is a yellow-legged species, with black pollinose spots on the frons of the female. In the male the abdomen is wholly silvery white pollinose, its pile wholly yellow.

Type locality.—Los Angeles County, California.

Type and allotype.—Male and female, No. 10413, U.S.N.M.

PSILOCEPHALA BACCATA Coquillett.

Plate 8, fig. 88.

1893. *Psilocephala baccata* COQUILLETT, Can. Ent., vol. 25, p. 226.

The types are in the National Museum. Coquillett's specimens were from Los Angeles and San Bernardino Counties, California. It is a species 5 to 7 mm. in length, wholly black in body color, including the halteres. The unusually short third antennal joint, the wholly black legs, and silvery white abdominal pile serve to distinguish the species. The antennae are shown in figure 88.

Type localities.—Los Angeles and San Bernardino Counties, California.

Type.—Male, No. 10411, U.S.N.M.

Distribution.—The two males examined were from the following localities: California—San Diego County (Harkins), [Stanford U.]; San Gabriel Mountains, southern California, June 5 (N. Banks), [M. C. Z.]

PSILOCEPHALA CINEREA, n.

Plate 6, fig. 60; plate 7, fig. 72; and plate 8, fig. 95.

Male.—Length 6.5 mm. General ground color black, the abdomen with silvery white pile. Head black, the occiput and cheeks with considerable white pile; bristles of occiput black. Frons mostly white pollinose, the upper corner of the triangle dull black, with some black and white pile. Antennae short, black, the first joint slightly shorter than the third, with white pile above at the base and several black bristles. (Fig. 95.) Palpi yellow, with white pile.

Thorax black, gray pollinose, with reclinate white pile and longer erect black pile; two pairs of praescutellar bristles. Scutellum gray pollinose and white pilose, with four bristles. Pleura gray pollinose, the meta and mesa pleura long white pilose. Coxae gray pollinose and white pilose. Halteres mostly brownish yellow, base of knob blackish, the outer part whitish pollinose.

Abdomen black, gray pollinose, thickly clothed with silvery white pile. Genitalia largely yellowish, the upper lamellae large, with slender, pointed projections. Tibiae except apices and basal half of metatarsi yellowish, the rest of the legs blackish brown; femora with reclinate white pile; bristles of the legs black. Wings hyaline, veins pale, stigma yellowish; anal cell closed before the wing margin and cell M-3 closed in the margin. (Fig. 72.)

Female.—Length 7 mm. Much like the male. Face and lower part of frons white pollinose, upper frons dark gray pollinose, a dull black irregular crossband between the colors, which merges into a semicircular black spot on the eye margin. (Fig. 60.) Two rows of strong black bristles on the occiput, not obscured by pile as in the male. Black pile of thorax short and sparse, the reclinate pile also short and yellowish. Two narrow pale stripes on thorax. Abdomen black, the first segment and venter gray pollinose; second segment with white posterior border; posterior margins of second, third, fourth, and most of fifth and sixth gray pollinose. Pile of basal half of abdomen white and black, all white on first segment; on the apical half of abdomen short black erect pilose. Wings as in the male; cell M-3 very narrowly open in the margin.

Type locality.—Holotype, a male, and allotype, a female, collected at Alamogordo, New Mexico, April 30 and May 30, 1902.

Types.—In the Academy of Natural Sciences, Philadelphia.

This species would run to couplet 5 in Kröber's table of species and to *baccata* in the table of females. It is related to *baccata* and *pavida*. There are two paratypes, a male and female, in the collection with the types.

PSILOCEPHALA PAVIDA Coquillett.

Plate 6, fig. 51; plate 7, fig. 77; and plate 8, figs. 84 and 98.

1893. *Psilocephala pavida* COQUILLETT, Can. Ent., vol. 25, p. 226.

Type locality.—Los Angeles County, California.

Type.—Male, No. 10412, U.S.N.M.

The following notes are made from specimens taken in southern California:

Male.—Length 6 mm. On upper corner of frontal triangle there are two small but quite noticeable tufts of black pile. First and third antennal joints about equal in length, the first joint swollen and with unusually long black bristles. (Fig. 84.) Pile of cheeks, palpi, and occiput largely black.

Thorax and scutellum dark, almost blackish gray pollinose, with two light-gray, widely separated, vittae; the lateral margins of thorax and margin of scutellum light gray; scutellum with four marginal bristles. Mesonotum with reclinate yellowish tomentumlike pile and erect black pile; pile of scutellum yellowish. Pile of pleura and coxae largely whitish. Stem of halteres brown, base of knob blackish, the larger part of the knob whitish. The reclinate pile of the femora white, the erect pile black, especially noticeable on the two front pair. Genitalia black, characteristic in form (fig. 98), largely yellowish white pilose.

Female.—Length 6 to 7 mm. From the description much like the female of *baccata*. Pollen of upper two-thirds of frons yellowish gray, with numerous short black hairs; the lower part of the frons silvery white, two small velvet black spots at the junction of the two colors as in *baccata*. (Fig. 51.) Pile of occiput, cheeks, and palpi white. Bristles of antennae shorter than in the male.

Reclinate yellow pile of the thorax denser, the erect black pile shorter than in the male. Pile of pleura white. Pile of femora shorter than in the male; four hind tibiae and bases of four hind tarsi reddish brown.

Distribution.—The five males and eight females examined were from the following localities: California—Redlands, August and September (Cole); East Highlands, October (Cole), [Cole]; Santa Clara County (Harkins), [Stanford U.]; Laguna Beach, August (Baker), [Pomona College].

PSILOCEPHALA FESTINA Coquillett.

Plate 7, fig. 68; and plate 8, figs. 82 and 106.

1893. *Psilocephala festina* COQUILLETT, Can. Ent., vol. 25, p. 225.

This is a rather slender species, 5.5 to 7 mm. in length.

Type locality.—Florida.

Types.—In C. W. Johnson's collection.

Distribution.—The distribution according to three males and six females examined is:

Florida: Daytona, April 8 (C. W. Johnson), [Cole]; Bradentown, March (M. C. Van Duzee), [Van Duzee].

Arizona: Safford, July 14 (E. G. Holt), [Biol. Surv.].

Mexico: Dos Arroyos in Guerrero, Vera Cruz, September (H. H. Smith), [Amer. Mus.].

PSILOCEPHALA AURANTIACA Coquillett.

Plate 6, fig. 52; plate 7, fig. 70; and plate 8, figs. 91 and 104.

1904. *Psilocephala aurantiaca* COQUILLETT, Proc. Wash. Ent. Soc., vol. 6, p. 177.

Male.—Length 7 mm. Head black, the proboscis, palpi, and first two antennal joints yellowish, apex of third antennal joint brown, the style short. Very few bristles on the short antennae, the third joint a little longer and broader than the first. (Fig. 91.) Pile of occiput and cheeks white, the bristles of the former black.

Thorax, scutellum, pleura, and coxae black, the color more or less obscured by dense gray pollen. A few short reclinate yellowish hairs on the dorsum of thorax and scutellum, two apical converging bristles on the latter. There are faint suggestions of thoracic markings, a median double stripe and two elongate side spots. Pleura almost bare of pile, there being only a few hairs on the metapleura. Halteres yellow.

Abdomen almost an orange yellow on first four segments, darker on fourth, and above on first, the remaining segments black, including the genitalia. Posterior margins of first four segments narrowly white, with reclinate silver pile. All the rest of the abdominal pile black, reclinate, sparse on the first four and more dense on the apical segments; sides of first three segments silvery pollinose along posterior margins, also the narrow posterior rims of the fifth and sixth segments. Genitalia quite large, the hypandrium projecting some distance beyond the upper portion. (Fig. 104.) Legs blackish brown, the knees and extreme apices of hind femora yellowish. Wings faintly infuscated, darker along some of the veins and outer part of cell first M-2; anal cell closed near the margin of the wing; cell M-3 wide open (fig. 70); stigma pale brown.

Female.—Length 8 mm. Very near the male in general appearance. Frons rather narrow, not much wider than the ocellar tubercle above, lower third silvery pollinose, the upper two-thirds brownish gray, with very short black pile; two small semicircular velvet black spots on the eye margin just above the silvery area of the frons. (Fig. 52.) The antennae darker than in the male. Thorax with a narrow median dark stripe. Abdomen much as in the male, the black pile from the fourth segment on is quite numerous and erect; there is some reddish color at the base of the fifth segment, the silvery posterior margin of this segment quite broad, and a lateral spot on the posterior margin of the sixth segment. Wings more hyaline than in the male; cell R beyond stigma pale brown and pale borders to veins R–4 and R–5 beyond the furcation.

Type locality.—Claremont, California (C. F. Baker).

I have selected as a neallotype a specimen taken at Alamogordo, New Mexico, May 15, 1902 [A. N. S. P.]

Type.—Male, No. 8035, U.S.N.M.

Distribution.—Among the specimens examined was a male taken at Alamogordo, New Mexico, May 15, 1902 [A. N. S. P.]; a male and female taken at the same place, June 2, 1902, and in the same collection. A male and female taken at Superstition Mount, Highley, Arizona June 13, 1917 (E. G. Holt), [Biol. Surv.].

PSILOCEPHALA SUBRUFA, new species.

Female.—Length 6.5 mm. Very near the preceding species. Differs in having the antennae pale yellow, with short black and yellow hairs; bristles of occiput, thorax, scutellum, and coxae yellow. The humeri, scutellum except base, praescutellar callosities, pleura, coxae and legs largely yellowish. Halteres yellow. Tips of tibiae, the last two tarsal joints, and apical portion of the first two brown. Bristles of legs black. Abdomen reddish yellow, short, sparse yellow pile on first segments, black pile on the remaining segments; a silvery spot on the posterior angles of the third and fifth segments. Wings infuscated about as in *P. aurantiaca* and the venation the same.

Type locality.—Holotype, female, collected at Highley, Arizona, June 13, on Superstition Mount (E. G. Holt).

Type.—In the collection of the United States Biological Survey.

This may be a color variety of *aurantiaca* Coquillett, as there are no apparent differences of structure in the females, but the male may prove to be different. The type is an unique specimen.

PSILOCEPHALA MORATA Coquillett.

Plate 6, fig. 40, and plate 8, figs. 83 and 105.

1893. *Psilocephala morata* COQUILLETT, Can. Ent., vol. 25, p. 225.

This species is near *festina* Coquillett. The antennae, female frons, and male genitalia are figured in this paper. The knob of the halteres is whitish yellow. The femora are yellowish brown to blackish brown. Cell M-3 may be narrowly open or closed in the margin of the wing; in one specimen examined vein M-3 did not reach the margin of the wing. The length is 6 to 7 mm.

Type localities.—New Jersey and Florida.

Types.—In C. W. Johnson's collection.

Distribution.—The distribution according to three males and three females examined is:

New Jersey: Cape May, June 7 (Daecke), [Harrisb. coll.]; Ocean City, June 10 (C. W. Johnson), [Cole]; Ocean City, June 10 [M. C. Van Duzee].

Florida: Gotha, March [Amer. Mus.].

PSILOCEPHALA OCCIPITALIS Adams.

1904. *Psilocephala occipitalis* ADAMS, Kans. Univ. Sci. Bull., vol. 2, p. 443, female.

The type is the only specimen known. The antennae are yellow with a black tip and arista. The thorax, abdomen, and legs are yellow.

Type locality.—Bill Williams Fork, Arizona.

Type.—In the Kansas University collection.

PSILOCEPHALA MARCIDA Coquillett.

Plate 6, fig. 56, and plate 8, figs. 79 and 97.

1893. *Psilocephala marcida* COQUILLETT, Can. Ent., vol. 25, p. 228.

Male.—Length 7.5 to 9 mm. Black, largely gray pollinose, and white pilose. Pollen in the central part of the frontal triangle golden yellow, the rest white. Face yellowish pollinose. Palpi and proboscis yellowish, with white pile. Antennae yellow, rather short, the third joint onion-shaped, but laterally compressed (fig. 79), bristles very short and black, a few yellow pile on the first joint; arista short and black. Occiput and cheeks whitish pollinose and pilose; postocular bristles yellow.

Mesonotum gray pollinose, with short reclinate pile; two narrowly separated light-brown median vittae, abbreviated posteriorly; on either side two narrower and shorter stripes; the median vittae abbreviated anteriorly and hardly reaching the scutellum. Bristles of the thorax yellow. Scutellum gray pollinose, the margin yellowish in ground color and with four yellow marginal bristles. Halteres yellow, with some brown color on the knob.

Abdomen largely blackish gray in ground color, in some specimens the dorsum almost entirely yellow, gray pollinose; posterior margins of all segments yellow. Genitalia yellow, and yellowish pilose, the gonopods attached to the hypandrium long. (Fig. 97.) Venter with faint traces of yellow on the posterior margins of segments. Pile of the dorsum silvery white, reclinate, more dense than on the venter. Coxae and femora largely brownish yellow, tibiae yellow with brownish tips, base of the tarsi yellow, the larger part brown; pile of the femora whitish. Wings whitish hyaline; stigma yellowish; the veins largely yellow; cross veins and fork of Rs black and faintly clouded, as are the veins closing the cell first A; cell M-3 closed and short petiolate.

Female.—Length 9 mm. Very nearly like the male in general appearance. Frons entirely yellow pollinose, very long and without markings (fig. 56), a few short black pile on the vertex. Mesonotum more uniformly brownish gray, the brown vittae not as distinct as in the male in the specimens examined; a few brown pile in addition to the white pile. Dorsum of abdomen largely yellow, the sides and venter largly blackish gray; thin pollen of abdomen gray; first four segments with reclinate white pile, the fourth with some erect black pile, the segments posterior to the fourth with short erect black pile. Genitalia and terminal circlet of spines yellowish. Legs entirely yellowish, the bristles blackish brown. Wings as in the male, the stigma brownish and the wings generally with a more brownish tinge.

Type locality.—Los Angeles and San Diego Counties, California.

Type.—Male, No. 10415, U.S.N.M.

I have designated as a neallotype a female collected at Coronado, San Diego County, California, July 9, 1890 (F. E. Blaisdell), [Cal. Acad. Sci.].

Distribution.—The distribution according to the seven males and three females examined is:

Arizona: Tucson, March 29 and April 8, Santa Catalina Mountains, 3 miles west of Sabine Canyon (J. F. Tucker), [Harrisb. coll.].

California: Santa Clara County, (Harkins), [Stanford U.]; Laguna Beach (Baker); Claremont (Baker), [both Pomona College]; Coronado, San Diego County, July 8 and 9 (F. E. Blaisdell); Oak Glen Lodge, San Bernardino County, 5,000 feet (F. Daggett), [both Cal. Acad. Sci.].

PSILOCEPHALA ACUTA Adams.

Plate 6, fig. 57; plate 7, fig. 67; and plate 8, fig. 87.

1903. *Psilocephala acuta* ADAMS, Kans. Univ. Sci. Bull., vol. 2, p. 222.

This species is easily recognized from the original description. There is a female in the Stanford University collection marked "type," probably a cotype, from which figures 57, 67, and 87 were made. The species is nearly related to *P. tergissa*, described below.

Type locality.—Englewood, Clark County, Kansas.

Types.—In the Kansas University collection.

PSILOCEPHALA TERGISSA (Say).

Plate 6, fig. 50, and plate 7, fig. 66.

1823. *Thereva tergissa* SAY, Journ. Acad. Nat. Sci. Phila., vol. 3, p. 39.
1828. *Thereva corusca* WIEDEMANN, Auss. Zw. Ins., vol. 1, p. 232.

Male.—Length 9 mm. Face golden yellow; frons silvery white below, golden brown above, the pile very sparse and minute. First and second antennal joints yellowish, third yellowish at base and brown at tip, the style black. Occiput golden brown above, silvery white below, the bristles black.

Thorax dark brown, with two darker vittae, the pile yellowish and sparse. Scutellum like the thorax. Pleura with whitish pollen.

Abdomen light brownish, semishining, with a silvery pollen above. Venter yellowish brown, with yellow incisures. The legs and wings are as in the female described below.

Female.—Length 8.5 to 9.5 mm. Resembling the male in many respects. The ocellar tubercle and upper half of the frons golden brown pollinose; just below the center, next each eye margin, a round velvet black spot (fig. 50); just above each spot a triangle of silvery pollen; the portion between the spots golden brown, below this silvery pollinose to the base of the antennae. Face and upper occiput yellowish brown pollinose, lower occiput grayish white pollinose; postocular bristles black; pile of lower occiput white. Third antennal joint yellowish, brown at the base and tip, the style black; pile and bristles of first two joints black; third joint laterally compressed, but slightly wider than the first and longer than the first and second combined.

Thorax, pleura, coxae, and scutellum yellowish or gray in ground color, with white pile. Mesonotum with four brown vittae and lateral brown spots; most of the pile reclinate whitish, a few erect, short black hairs. Scutellum with two marginal black bristles. Bristles of the thorax black.

Abdomen brown, semishining; pile of first three segments short, reclinate whitish, beyond the third segment erect and black as usual; posterior margins of the segments yellowish, in some specimens the whole dorsum more or less yellowish; first segment gray pollinose. Stem of halteres whitish, the knob blackish brown. Femora yellowish or yellowish brown; tibiae, except apices, and base of tarsi yellowish, the remainder of the tarsi blackish brown. Wings whitish hyaline, the veins partly yellow and partly brown. (Fig. 66.)

Type locality.—Eastern Florida.

Type.—Not in existence.

Distribution.—The 2 males and 10 females examined were from the following localities: Florida—Pensacola, October 11; Marco, April

21; De Funiak Springs, October 17 [Amer. Mus.]; Gotha, March [Cornell]; Turkey Creek, March 3; Anna Maria Key, March 30; Seven Oaks, May 1 (M. C. Van Duzee), [all M. C. Van Duzee].

PSILOCEPHALA SENILIS (Fabricius).

1805. *Bibo senilis* FABRICIUS, Syst. Antliat., p. 68.
1821. *Thereva senilis* WIEDEMANN, Exot. Dipt., vol. 4, p. 112.

Kröber redescribes the species from two poorly preserved specimens in his paper on the North American Therevidae, but his description is quite complete. The male was from Brazil, the female from Savannah, Georgia; these specimens were not acquired by the National Museum. It would be difficult to place the species with relation to others without seeing specimens.

PSILOCEPHALA POLLINOSA, new species.

Plate 8, fig. 92.

Male.—Black, white pollinose. Frons black, silvery white pollinose, with a central depression, deeper above the antennae. Antennae short, black, the first and second joints with short black bristles; third joint almost as long as the first and second combined and a little wider; the arista short. (Fig. 92.) Face silvery white pollinose; palpi black, white pollinose. Occiput whitish pollinose and pilose, the post-ocular bristles black; short pile on ocellar tubercle black.

Thorax black, the mesonotum and pleura rather long, erect white pilose and gray pollinose; scutellum the same color, almost shining black in the middle, with four black marginal bristles and long white pile. Knob of halteres largely yellowish, whitish pollinose, the basal part and stem blackish.

Abdomen black, gray or silvery gray pollinose, long silvery white pilose, reclinate on the dorsum, more erect on the sides and venter; sixth and seventh segments very short, the fifth, sixth, and seventh combined about equal to the third. Genitalia black on the exterior, short yellowish pilose on the upper part, long on the hypandrium and with a few black hairs in the center; the exterior genitalia gray pollinose. Femora, tips of tibiae, and tarsi except base black; base of tarsi and tibiae yellowish; femora with short white pile; bristles of legs black. Wings hyaline, R-1 yellow, the rest of the veins and the stigma brown; cell M-3 wide open.

Holotype.—A male collected at Tuolumne Meadows, California, August 1, 1915 (C. L. Fox), [Cal. Acad. of Sciences].

In general appearance this species resembles *limata*. It stands near the genus *Dialineura* in some respects, but the antennae are of different structure.

PSILOCEPHALA LATIFRONS, new species.

Plate 6, fig. 61.

Male.—Black, gray pollinose species. Frons bare, silvery gray pollinose, rather large, *the eyes separated at the vertex by the width of the ocellar tubercle;* ocellar tubercle with black pile. Antennae short, first joint as long as the third. rather heavy, it and the second joint gray pollinose; first and second joints with quite long pile and a few short black bristles on the outside and below. Cheeks with a dark spot on which there are some black hairs. Occiput gray pollinose and white pilose, the post-ocular bristles black.

Dorsum of thorax blackish gray, with two widely separated vittae and the lateral margins whitish gray; pile of thorax erect, white. Pleura black, gray pollinose and white pilose. Scutellum gray pollinose, white pilose, with four marginal bristles. Halteres blackish, the knob thinly gray pollinose.

Abdomen black, densely gray pollinose, silvery on the dorsum, the thick reclinate pile silvery white. All the abdominal pile white. Genitalia small, black, the upper portion larger than the hypandrium and gray pollinose; a few black hairs on the hypandrium. Abdomen quite long; with seven distinct segments before the genitalia. Femora, and tarsi except bases, tibiae except tips, black; bases of tarsi and basal portion of tibiae reddish brown; pile of femora white. Wings hyaline, the veins brown, stigma dark brown; cell M-3 wide open.

Type locality.—Holotype, a male, collected at West Danby, New York, May 30, 1915.

Type.—In the Cornell University collection.

Distribution.—The distribution according to the six males examined is:

Canada: County Prince Edward, Ontario, May 24 (Evans), [Canad. coll.].

New York: The type specimen.

New Jersey: Camden, May 4 (M. C. Van Duzee), [Van Duzee]; Toms River, May 30 [C. W. Johnson].

Pennsylvania: Allegheny County [Carnegie Mus.]; Conewago, April 16 [Harrisb. coll.].

All specimens (five) other than the type are paratypes.

Maj. E. E. Austen, of the British Museum, has kindly examined the types of Walker's six species of North American Therevidae and finds that three of them belong to the genus *Psilocephala*. Although it is not possible to tell with certainty what the species are until all the described species are better known, I have thought it best to include Walker's descriptions, as the species will some day be worked out.

PSILOCEPHALA GERMANA (Walker)

1848. *Thereva germana* WALKER, List Dipt. Brit. Mus., vol. 1, p. 222.

The original description reads as follows:

Fusca, capite cinereo subtus albo, thoracis vittis duabus lateribus pectoreque cinereis, abdomine nigro-argenteo micante, antennis nigris, pedibus fulvis, alis subcinereis.

Head gray behind, white in front and beneath, where it is thickly clothed with white hairs; eyes red; feelers and mouth black, the former clothed with black bristles, the latter with white hairs; chest dark brown, and two slender gray stripes; its sides and the breast also gray, and the latter thickly clothed with white hairs; abdomen black, covered with silvery glance; hind border of each segment clothed with yellowish white hairs; hips gray, clothed with white hairs; thighs and shanks tawny, armed with black bristles; feet darker, clothed with black hairs, tips of the joints black; wings slightly gray; brands brown; veins piceous, slightly bordered with brown in the disk of the wing; a black dot just above the cross veins near the tip of the wing; poisers ferruginous, with piceous knobs. Length of the body 3 lines; of the wings 6 lines.

Var.—Tips of the thighs and of the shanks darker; wing veins not bordered with brown.

Florida: Presented by E. Doubleday, Esq.

The type is reported to be in good condition.

Type.—In the British Museum.

PSILOCEPHALA VICINA (Walker).

1848. *Thereva vicina* WALKER, List Dipt. Brit. Mus., vol. 1, p. 222.

The original description is as follows:

Mas. Fusca aut nigra, capite nigro, abdomine cinereo fasciis fulvis apice nigro, antennis nigris, pedibus cinereis, tibiis fulvis, tibiis anticis tarsisque piceis, tarsis posterioribus basi nonnunquam fulvis alis limpidis.

Head black, with a few black bristles above, thickly clothed with white hairs behind and beneath; eyes red; feelers and mouth black, thinly clothed with short black hairs; chest and breast brown, the former clothed with gray hairs and black bristles, the latter with white hairs; abdomen dark gray, clothed with hoary hairs; hind border of each segment tawny; last segment black, shining; hips and thighs gray, clothed with white hairs; shanks tawny, darker at the tips; feet and fore shanks piceous; wings colourless; brands brown and narrow; veins piceous; poisers piceous, with ferruginous knobs. Length of the body 3½–4 lines; of the wings 6½–7 lines.

Var.—Chest and breast black; hind borders of only the second and third abdominal segments tawny; four hinder feet tawny at the base.

Nova Scotia: From Lieutenant Redman's collection.

The type is reported to be in good condition

Type.—In the British Museum.

PSILOCEPHALA CONSPICUA (Walker).

1848. *Thereva conspicua* WALKER, List Dipt. Brit. Mus., vol. 1, p. 223.

The type is a female, not a male as stated by Walker.

Fusca, capite fulvo subtus cano, thorace fulvo bivittato, pectore cinereo, abdomine nigro albo trimaculato, pedibus cinereis, tibiis fulvis, tarsis piceis, alis subcinereis.

Head tawny above, white in front, hoary behind and beneath, where it is clothed with white hairs; there are a few black bristles behind the eyes, which are red; feelers gray; the first joint clothed with black hairs; chest dark brown, with two tawny stripes; the sides hoary; breast gray; abdomen black, shining, thinly clothed with short black hairs; there is a large triangular white spot on the hind border of each of the segments from the first to the third; the first is narrower than the other two spots, and the second is larger than the third, and they are all clothed with white hairs; legs gray; shanks tawny, feet piceous; wings slightly gray; brands brown; veins piceous, very slightly bordered with brown; poisers dark ferruginous, their knobs piceous from the base to the middle, pale yellow thence to the tips. Length of the body 4 lines; of the wings 8 lines.

a. Nova Scotia: From Lieutenant Redman's collection.

Type.—In the British Museum.

Austin reports the type to be in fairly good condition and adds the following notes to the description:

The abdominal spots are paired, and occupy the anterior and posterior angles of the second (visible) tergite and the posterior angles of the third; in the case of the first pair, each spot is more or less concealed by a long fringe of backwardly directed, silvery white hair on the hind margin of the preceding segment. Although Walker does not mention it, the fifth abdominal tergite bears a deep, whitish gray pollinose, transverse band, almost or narrowly interrupted in the middle line by a forwardly and a backwardly directed triangular indentation, formed by the shining black ground color.

The writer obtained a copy of Kröber's paper, Beitrage zur Kenntnis der Thereviden und Omphraliden, published in 1914, after the type had been set up for this paper. There was no opportunity to place the species in this paper in relation to other species studied by the writer. The writer has not seen specimens of any of the eight new species of *Psilocephala* described from North America in this last paper by Kröber. Translations of the original descriptions are given below.

PSILOCEPHALA PALLIDA Kröber.

1914. *Psilocephala pallida* KRÖBER, Beiheft z. Jahrb. Hamb. Wiss. Anstalten, vol. 31, p. 45.

The species is said to be very near *marcida.*

Male.—Length 7.5 mm. The head is silky brown, with indefinite blackish brown spots on the frons. The antennae are pale yellow, the third joint whitish, the style black. The occiput is dark brown above, pale gray below; the pile is white.

The mesonotum is grayish brown with a greenish tinge, thin white pilose. The halteres are pale yellow. The abdomen is pale yellowish brown in ground color, with thick whitish pile above; the anal segments are yellowish brown. The wings are somewhat yellowish, the stigma small, blackish brown; all the cross veins are thick, black, also the endings of the longitudinal veins; all of the posterior cells have blackish centers.

Type locality.—One male, taken in Texas, June 19.

Type.—In the United States National Museum, Cat. No. 20018.

PSILOCEPHALA MACULIPENNIS Kröber.

1914. *Psilocephala maculipennis* Kröber, Beiheft z. Jahrb. Hamb. Wiss. Anstalten, vol. 31, p. 45.

Male.—Length 9 mm. Very near *tergissa.* The head is yellowish gray tomentose, the antennae pale yellow with the tip of the third joint and the style black. The mesonotum is blackish green with indefinite pale stripes.

All the legs are pale yellowish brown. The abdomen has not the brown tomentum of *tergissa;* the anal segment is reddish yellow, club-shaped. The wings are hyaline, with strong veins, the cross veins all broadly bordered with brown. The longitudinal veins have spots only at the tips; the stigma is pale.

Type locality.—Two males were taken in San Jose del Cabo, Mexico (probably the place by that name at the tip of the peninsula of Lower California).

Type.—In the United States National Museum, Cat. No. 26019.

PSILOCEPHALA BRUNNEA Kröber.

1914. *Psilocephala brunnea* Kröber, Beiheft z. Jahrb. Hamb. Wiss. Anstalten, vol. 31, p. 46.

Female.—Length 10 mm. A large, predominately reddish yellow species, with reddish yellow bristles on mesonotum and scutellum. The frons is light reddish yellow tomentose, the antennae short and pale reddish yellow, the third joint onion-shaped, with a short blunt style. The occiput is blackish, thin whitish pilose. The legs are pale yellowish brown. The halteres are yellowish brown, also the abdomen, which has darker parts but no pale bands. The wings are tinged pale brown, the stigma is pale yellow.

Type locality.—Oracle, Arizona. The specimen taken June 29.

Type.—In the United States National Museum, Cat. No. 26020.

PSILOCEPHALA PILOSA Kröber.

1914. *Psilocephala pilosa* Kröber, Beiheft z. Jahrb. Hamb. Wiss. Anstalten, vol. 31, p. 47.

Male.—Length 8mm. Very near *pavida.* A small, slender, largely black haired species; differing from *pilosula* Bigot, from South America, in the black tibiae. The head is yellowish white, shining, the frontal triangle black, with a yellow median line. The antennae are short, black, the third joint slender, the first and second very long and strongly black bristled.

The mesonotum is dull, black, whitish tomentose, with two fine white lines; the pile is long and black, but thin. Halteres and legs are wholly black. The abdomen is blackish and thick pilose, with yellowish white pile at the base and white beyond, the anal segment long white haired. The wings are hyaline with a large black stigma.

Type locality.—Hot Springs, Arizona, June 20.|

Type.—In the United States National Museum, Cat. No. 26021.

PSILOCEPHALA PLATYPTERA Kröber.

1914. *Psilocephala platyptera* KRÖBER, Beiheft z. Jahrb. Hamb. Wiss. Anstalten, vol. 31, p. 47.

Male.—Length 8 mm. The most beautiful and extraordinary Therevid of Central America; perhaps the representative of a new genus. The head is almost round and is silver white pilose, the antennae and mouth parts light reddish yellow, the bristles delicate, black. The mesonotum, scutellum, pleura, and coxae are pure silver white. The abdomen is silvery, the second segment with deep black lateral triangles, the third with a deep black cross band. The venter is black. The legs and halteres are blackish brown. The wings are hyaline, longer than the abdomen and broad; the whole wing tip is dark satin brown with a small cross band in the fourth posterior cell and one beginning on the stigma and running to the anal cell.

Type locality.—Rockstone Essequebo, Guatemala.

Type.—In the United States National Museum, Cat. No. 26022.

PSILOCEPHALA NIGRINA Kröber.

1914. *Psilocephala nigrina* KRÖBER, Beiheft z. Jahrb. Hamb. Wiss. Anstalten, vol. 31, p. 53.

Female.—Length 7 mm. Very near *P. munda*, but the frontal callosity is rounded out and smooth and a black stripe runs from it to the antennae. The antennae are black, very robust, especially the third joint, which appears pear-shaped, with a short, thick style. The halteres are deep black. The legs are black, the tibiae and metatarsi dusty brown. The abdomen is shining black, the second and third segemnts with small silver side spots on the posterior margins, the fifth segment with a wide band. The wings are brownish, almost blackish tinged.

Type locality.—Florissant, Colorado, June 14.

Type.—In the United States National Museum, Cat. No. 26023.

PSILOCEPHALA LACTEIPENNIS Kröber.

1914. *Psilosephala lacteipennis* KRÖBER, Beiheft z. Jahrb. Hamb. Wiss. Anstalten, vol. 31, p. 53.

Male.—Length 6 mm. A very beautiful, characteristic species. The head is silvery white, shining, only the frontal triangle velvet black. The antennae are slender, black. The pile is rather delicate, snow white. The mesonotum is dull, pale gray, with a broad, deep black stripe from the wing base to the shoulder. There is a delicate brown median mesonotal vitta viewed from behind. The pleura are whitish gray. The halteres are blackish brown. The femora are black, with dense white pile and tomentum; the tibiae and metatarsi are pale yellowish brown. The abdomen is blue gray on the sides, almost without shine. The anal segment is pale reddish yellow. The wings are intense milk white, the veins whitish, only the first and second veins yellowish brown.

Type locality.—Florida.

Type.—In the United States National Museum, Cat. No. 26024.

PSILOCEPHALA RUGIFRONS Kröber.

1914. *Psilocephala rugifrons* KRÖBER, Beiheft z. Jahrb. Hamb. Wiss. Anstalten, vol. 31, p. 54.

Female.—Very near *munda* and *haemorrhoidalis.* The frontal callus begins directly over the antennae and is at first smooth rounded, then flat and cross wrinkled. The face is black, with dusty pollen, not white. The antennae are black, slender, gray tomentose, with sparse white pile. The mesonotum is black, dull, seen from the front with warm brown reflections and two pale whitish lines. There is a shining black stripe from the wing base to the shoulder. The pleura are shining black, in part silvery tomentose. The halteres are blackish brown.

The femora are shining black, the fore femora thick, silvery white pilose; the tibiae are yellowish brown, with black tips. The scutellum is shining black, the outer tip whitish yellow. The abdomen is black, shining, almost bare, the second segment broad white on posterior margin, the fifth segment silvery. The anal segment is redish yellow haired and bristled. The wings are hyaline, the stigma large and blackish brown.

Type locality.—Sierra Madre, Chihuahua, Mexico, 7,300 feet, March 6.

Type.—In the United States National Museum, Cat. No. 26025.

Genus DIALINEURA Rondani.

1856. *Dialineura* RONDANI, Dipt. Ital. Prodr., vol. 1, p. 155.
1865. *Pachyrrhiza* PHILIPPI, Verh. Zool.-bot. Ges. Wien, vol. 15, p. 703.

In this genus are placed the species having a bare face, open cell M-3, and an unusually dilated first antennal joint, which is pollinose, hairy, and with strong bristles. The species resemble *Thereva* closely and also a few species of *Psilocephala.* The frons of the female is without the shining callosities found in most species of *Thereva,* and the surface is uneven as in *Metaphragma,* not evenly convex. The abdomen is more conical in form than in most species of *Psilocephala.* The males are holoptic and have the genitalia pollinose on the exterior. The genus was founded on *D. anilis*, the only European representative. In the opinion of the writer *Tabuda* is best kept as a separate genus.

DIALINEURA MELANOPHLEBA (Loew).

Plate 9, figs. 108, 111, and 112.

1876. *Thereva melanophleba* LOEW, Zeitschr. Ges. Natur., new ser., vol. 14, p. 317.

This small species should be quite easily recognized from Loew's description and the figures given on plate 9. In spite of the partially hairy face this species seems to fit well in the genus *Dialineura.* The female frons suggests *Tabuda* and *Metaphragma* more than *Thereva.* The types were collected in San Francisco, California, by Edwards, and are presumably in the Loew and Osten Sacken collection in Cambridge. In a female from Nevada the crossband on the frons shows blackish in certain lights beneath the blackish pile.

Type locality.—San Francisco, California (Edwards).

Type.—In the Museum of Comparative Zoology at Cambridge.

Distribution.—The two males and one female examined were from the following localities:

Nevada: No other data, in Loew collection [M. C. Z.].

California: San Francisco, May 25 (E. C. Van Dyke) and February 22 (F. X. Williams), [Cal. Acad. Sci.].

DIALINEURA CRASSICORNIS (Williston).

Plate 9, figs. 109 and 110.

1886. *Thereva crassicornis* WILLISTON, Trans. Amer. Ent. Soc., vol. 13, p. 293.
1893. *Psilocephala crassicornis* WILLISTON, Coquillett in Can. Ent., vol. 25, 222.

Male.—Length 11 to 12 mm. Head black; eyes separated by only a pollinose line; ocellar tubercle gray pollinose; frontal triangle dark gray with silvery reflections, lighter on the sides. Face and cheeks silvery white pollinose, also the lower occiput; upper occiput more gray; occiput and cheeks with dense white pile, which reaches up a short distance on the face. Palpi and proboscis black, white pilose, with a few black hairs. First antennal joint gray pollinose, about twice as long as the second and third combined, with long erect black bristles and white pile, a few of the hairs black (fig. 109); the second and third joints also gray pollinose, the second short black pilose; the style black, with a short apical bristle. Bristles of occiput slender and black.

Thorax and scutellum black, gray pollinose, darker on the mesonotum, with two light-gray vittae; mesonotum with erect black pile and more or less reclinate white pile, the bristles black; pile of scutellum long and white; four black marginal bristles. Pleura and coxae black, dense silvery gray pollinose and long white pilose, a few black hairs in front of the wing base. Halteres blackish, the knob silvery gray pollinose.

Abdomen black, entirely covered with silvery white or gray pollen, the pile white, that on the dorsum reclinate and with a silvery caste. Genitalia blackish, largely thin gray pollinose, the ends of upper forceps reddish and with a tuft of black bristles (fig. 110), the bristlelike hairs of hypandrium almost all black, most of the pile of upper forceps shorter and whitish. Femora black, white pilose, tibiae brownish yellow with darker tips; base of tarsi brownish yellow, the rest black. Wings gray hyaline, stigma blackish; veins black, the cross veins and fork of Rs clouded brown; cell M-3 wide open.

Female.—Length 11 to 12 mm. Like the male, but without the silvery white pollen and with shorter white pile. Frons much wider below than above, the upper half gray pollinose with short whitish and black pile, the lower half silvery gray pollinose, between the colors on each side a velvety black triangular mark, broad on the eye margin, the narrow part not reaching the center of the frons. Outside the base of antennae a dark-gray spot.

The two thoracic vittae are yellowish gray, a faint suggestion of a median stripe. Mesonotum with reclinate whitish pile, the erect black pile shorter than in male. First abdominal segment gray pollinose, the second and third largely semishining blackish, the lateral margins and posterior margins to near the middle gray pollinose; base of fourth segment and middle of segments four to seven gray black, the sides gray pollinose. Pile of the first three segments reclinate yellowish white and erect white, longer on the first; segments four to seven short erect black pilose. Genitalia largely shining black, with short, dense, erect black pile. Venter entirely gray pollinose, posterior margins of second and third segments yellowish white. Wings as in the male.

Type locality.—California.

Type.—In Kansas University collection.

Distribution.—The distribution according to 26 males and 14 females is:

Washington: Forks, Clallam County, July 2 (E. P. Van Duzee), [Cal. Acad. Sci.]; Skykomish River, May 3, 1892 [Cornell].

Oregon: Hood River, May 10 to June 6 (Cole), [Cole].

California: Lagunitas Creek, April 15 (Osten Sacken), and Marin County. (H. Edwards), [M. C. Z.]; Stanford University, April 27 to May 10 (Cole), [Cole].

Genus TABUDA Walker.

1852. *Tabuda* WALKER, Ins. Saund., Dipt., vol. 1, p. 197.

Walker's characterization of his genus is as follows:

> Allied to *Apatomyza*, but there are five posterior areolets; the first is long; the second and third short and of equal length; the fourth is about twice the length of the

third; the fifth is much broader and a little longer than the fourth; the first inferior areolet is closed.

This description is of course inadequate, but the specific description is recognizable.

Verrall considered *Tabuda* as a possible synonym of *Xestomyza*, and it is undoubtedly closely related to that genus and to *Metaphragma*. The known species differ in general coloration and general habitus from *Dialineura*, and the eyes of the male are broadly separated, not holoptic as in that genus; the frons of the female is like that of *Metaphragma*, not evenly convex as in *Thereva* and more horizontal. The anal lamellae of the male genitalia are very large.

TABUDA FULVIPES Walker.

Plate 9, figs. 113, 115, and 117.

1852. *Tabuda fulvipes* WALKER, Ins. Saund., Dipt., vol. 1, p. 197.

Male.—Length 8 to 9 mm. Head more horizontal than vertical, the eyes separated almost the width of the ocellar tubercle. Frons and ocellar tubercle gray pollinose, lower half of frons with long black pile; face gray pollinose, a brown mark from the base of antenna to eye, the black pile on sides of face reaching almost up to this mark. Cheeks white pollinose and pilose; occiput white pilose, the lower part white pollinose, the upper gray; post-ocular bristles numerous, black, long near the eye margin. Antennae brown, the first two joints gray pollinose; first antennal joint more than twice the length of the second and third combined and greatly swollen (fig. 113), pile black, bristles on apical half black; second joint very small, with short black pile. Palpi yellowish, with long white pile.

Thorax black, mesonotum and scutellum grayish brown pollinose; pleura and coxae gray pollinose and white pilose; mesonotum with reclinate white pile and erect black pile; scutellum with white pile and four marginal black bristles. Stem of halteres yellowish, the knob yellowish brown, base of the knob blackish brown.

Abdomen black, gray pollinose, the dorsum silvery, the venter somewhat silvery beyond the first segment. All the abdominal pile white. Abdomen with seven visible segments, the fifth, sixth, and seventh about equal in length to the fourth. Genitalia, including the large anal lamellae, brownish yellow, most of the pile white, but with a few black hairs; short black hairs on the anal lamellae. Structure of the genitalia quite characteristic. (Fig. 115.) Venter with a white posterior margin on the second segment. Femora brownish yellow, the tips blackish, the pile white; tibiae and the first two tarsal joints yellowish, the apices and the other tarsal segments black. Wings whitish hyaline, the veins and stigma brown; costal region faintly infuscated, the veins in the median portion of the wing with a narrow border of brown, more noticeable on the cross veins; cell M-3 wide open.

Female.—Length 9 mm. Like the male. Frons very broad, with a shallow central depression, covered with dense gray pollen; a small brown spot on eye margin above antenna; pile sparse, black. The mesonotum and abdomen brownish pollinose; the three gray vittae on mesonotum equidistant; erect black and reclinate white pile. The first three abdominal segments yellowish pilose, the remaining segments short, erect black pilose as usual in many species of *Thereva* and *Psilocephala*.

Type locality.—Walker gave no locality. Osten Sacken reported the species from Georgia.

Type.—In the British Museum.

Distribution.—The distribution according to 14 males and 2 females examined is:

Massachusetts: Ellis, May 11 (C. W. Johnson), [Cole]; Boston, May (A. L. Melander), [Cole]; Framingham, May 14 (M. C. Van Duzee), [Van Duzee].

New Jersey: Riverton, April 20 (C. W. Johnson), [Cole]; Riverton, April 27 [Kans. U.]; Manumuskin, April 24 to May 5 (Daecke), [Harrisb. coll.].

North Carolina: Southern Pines, March 25 (A. H. Manee), [Dr. Dietz].

TABUDA BOREALIS, new species.

Plate 9, figs. 114 and 116.

Male.—Length 9 mm. The specimen described is considerably greased and the color of the pollen on the body can be seen only in small patches. The body is brownish black. Eyes separated by a space as wide as the ocellar tubercle; frons yellowish brown pollinose, with sparse yellowish pile above the antennae and on the vertex. Face colored and pollinose like the frons, the lower face, cheeks, and occiput with brownish yellow pile; post-ocular bristles black. First antennal joint brown, considerably longer than the blackish third (fig. 114), with long yellowish and black pile, the bristles on apical half black. Mouth parts brown, with long yellowish brown pile.

Thorax blackish brown, evidently yellowish gray pollinose and golden brown pilose, the pile quite dense; thoracic bristles and a few hairs black. Scutellum blackish brown, the dense erect pile colored like that on the thorax, with four black marginal bristles. Halteres brownish yellow, the base of the knob black. Pleura and coxae blackish brown, yellowish brown pilose.

Abdomen dull brown, with yellowish pollen and yellowish brown pile as on the thorax; median portion of the first three segments and all of the following segments with pile colored like that on the dorsum. Genitalia brown, differing considerably in shape from genitalia of *T. fulvipes* (fig. 116), with more or less yellowish pollen; pile brownish, short above, long and with a few black hairs intermixed on the hypandrium. Femora blackish brown, the apices of femora, tibiae except apices, and bases of tarsi yellowish; apices of tibiae and rest of tarsi black; pile of femora yellowish, that on the hind femora short and reclinate. Wings gray hyaline, the veins brown, the costa and subcosta yellow; cell M-3 wide open. In fresh specimens the cross veins are evidently clouded brown.

Female.—Length 10 mm. Very nearly like the male. Frons much broader and with two tufts of brown pile near the middle, one each side of the median line. Pile of vertex blackish, on the lower third of frons yellow. There is a shallow depression running across the middle of the frons. Pile of the mesonotum yellowish, more dense than in the male, with a few black hairs intermixed. Abdomen more or less greased but evidently almost entirely brownish yellow pollinose, the bases of the segments darker; pile of first three segments reclinate, yellowish, the other segments short erect black. Genitalia blackish, the short pile and circlet of blunt bristles yellow.

Type locality.—Gull Lake, Saskatchewan, Canada, April 30, 1908, on sand by coyote holes (T. N. Willing).

Type.—Male, in the collection of C. W. Johnson; allotype, female, in same.

The two types are the only specimens known; they were sent to Kröber for examination and were determined by him as *Tabuda fulvipes* Walker.

Genus METAPHRAGMA Coquillett.

1894. *Metaphragma* COQUILLETT, Journ. New York, Ent. Soc., vol. 2, p. 97.

Head much broader than long; eyes of male separated the width of the ocellar tubercle. First antennal joint almost as long as the head, much longer than the second and third combined and greatly thickened, with long pile but no distinct bristles; the style is apical. Head rather flattened and horizontal in shape, the frons and face greatly retreating; face thickly pilose; proboscis nearly as long as the head.

General shape of body much as in *Thereva.* Wing with an extra cross vein in cell R-5, outside of small cross vein and beyond the fork of Rs; the wing is otherwise much as in *Thereva.*

The presence of this cross vein alone does not seem to be a very good generic character and perhaps this species should be placed in *Xestomyza.*

Genotype.—*Xestomyza planiceps* Loew.

METAPHRAGMA PLANICEPS (Loew).

Plate 10, fig. 118.

1872. *Xestomyza planiceps* Loew, Berlin. Ent. Zeitschr., vol. 16, p. 75.

Male.—Length 9 mm. Head black, eyes separated at vertex by the width of the ocellar tubercle; pile of vertex and lower frons long erect black, the middle of the frons with scarcely any pile. Frons swollen at the base of each antenna. The black pile of frons reaches almost to the lower corner of the eye. Face and cheeks whitish pollinose, the occiput dark gray; pile of upper occiput and the bristles black; pile of cheeks long, dense, white, reaching almost to the black pile of the face. Palpi black, gray pollinose and long white pilose. First antennal joint unusually long and robust (fig. 118), almost as long as head, gray pollinose, the apical half with long black bristles, pile long erect and black; second antennal joint very small, short, black pilose; third joint black, scarcely wider than the second, with a very small style.

Thorax black, the mesonotum more or less flattened, gray-black pollinose, with short reclinate white pile and more dense erect black pile. Scutellum colored like the mesonotum, with long white pile and four black marginal bristles. Pleura and coxae dense grayish white pollinose and white pilose. Stem of halteres yellowish, the knob black, thinly gray pollinose.

Abdomen black, densely silvery gray pollinose, the pile silvery white, dense, and reclinate on the dorsum. Genitalia black, gray pollinose, white pilose, the hypandrium small. (Fig. 118.) Femora black, gray pollinose, white pilose, the tips yellow; tibiae yellow with black tips, the tarsi black with bases yellow. Bristles of legs black. Wings whitish hyaline, the cross veins narrowly bordered gray, the costal margin narrowly blackish gray.

Female.—Length 12 mm. Very nearly like the male, the frons considerably broader. Pile of femora shorter, on the hind femora reclinate. Abdomen black, thinly gray pollinose, the seventh segment and genitalia shining blackish brown; first three segments reclinate yellowish white pilose, on the remaining segments, including the genitalia erect black pilose, the circlet of bristles black.

Type locality.—California (Edwards).

Type.—In the Museum of Comparative Zoology at Cambridge.

Distribution.—The distribution according to 10 males and 4 females examined is:

Canada: Okanagan Falls, British Columbia, April 29 (E. M. Anderson), [R. S. Sherman]; Penticton, British Columbia, April 30 (E. R. Buckell), [Canad. coll].

Washington: Lind, April 21 (Cole), [Cole]; Wawawai [R. C. Shannon].

California: San Francisco, March 26 to April 19 (E. C. Van Dyke), [Cal. Acad. Sci.]; "Cal." (Edwards), [Amer. Mus.]; La Quinta, San Bernardino County, April (Cole), [Cole].

Genus THEREVA Latreille.

1796. *Thereva* LATREILLE, Precis Caract. gener. Ins., p. 167.
1775. *Bibio* FABRICIUS (not Geoffroy), Syst. Ent., p. 756.
1840. *Exopata* MACQUART, Dipt. Exot., vol. 2, p. 76.
Thereva LOEW and many other authors.

Very nearly like *Psilocephala*, usually larger and more thickly pilose, the main distinguishing character being the hairiness of the face; the head is of much the same shape as *Psilocephala*. The frons of the male is usually thickly pilose and in both sexes the face, cheeks, and occiput are pilose, often densely so in the male; in many species the frons of the female offers good specific characters, having velvety black or shining black marks or callosities which vary greatly in shape and size. The antennae do not vary so greatly in shape as in *Psilocephala* and are always shorter than the head, the color usually being constant and of specific importance; the basal joint is rather long and cylindrical, never greatly inflated, with some pile and with bristles on the apical portion; second joint short and with short pile; the third joint divergent, about as long as the first, with the appearance of an annulation at the base, with no pile and with a short apical style, at the end of which there is a very short bristle.

The thorax is about as in *Psilocephala*, often densely pilose in the male; the thoracic bristles arranged in about the same manner as in *Psilocephala*. There are two pairs of marginal bristles on the scutellum.

The abdomen is conical and longer than the thorax, with seven or eight obvious segments in the male, the eighth segment in the female being the base of the ovipositor. The dorsum of the abdomen is never flattened and densely silvery pollinose as in many species of *Psilocephala*, with the exception of one aberrant species. The male genitalia are distinct, but do not show the unusual development found in some of the other genera and are proportionately rather small; in some species that are well differentiated in other ways the external male genitalia are apparently the same in structure.

The legs are much the same as in *Psilocephala*, but in most species with more bristles; in the males the femora often long dense pilose; the bristles of the hind femora form an irregular antero-ventral row of about seven; the bristles of the tibiae arranged about as in *Psilocephala*—three rows of three to six bristles on the front, four rows of four to seven on the middle, and four rows of about eight on the hind tibiae. There is some specific and some individual variation.

The venation is the normal one for the family. There seems to be more individual variation in this genus than in *Psilocephala;* cell M-3 may be closed or open in the same species, or closed in one wing of a specimen and open in the other. R-4 is never sharply curved. In some species the wings are generally infuscated or spotted, in the majority of species hyaline, or the cross veins clouded.

In the following tables of species Walker's three species—*varia*, *nervosa*, and *senex*—are not included because it is impossible to identify them with certainty at present. Although the female of *T. strigipes* is well marked, I have seen only one poorly preserved male, which I have described. In the table of females *anomala* Adams, *nigra* Say, and *bolbocera* Osten Sacken are omitted, the first two because of inadequate descriptions. *T. crassicornis* Bellardi and *T. ruficornis* Macquart are not included in the tables; the first species may be recognized some day from Mexican material, but the description of the latter is too brief to identify the species.

TABLE OF MALES.[10]

1. Small, *Psilocephala*-like species, the abdominal tergites rather flattened and silvery pollinose.......... 2.
   Species over 6 mm. in length; the abdomen conical in general shape and not silvery above.......... 4.
2. Wings with two brown crossbands.......... **anomala** Adams.
   Wings hyaline.......... 3.
3. Sides of the second to fifth abdominal segments shining black; front legs wholly black.......... **pygmaea**, new species.
   Sides of the abdomen gray pollinose; front tibiae except the apex and the tarsi yellow.......... **melanoneura** Loew.
4. Abdomen whitish pollinose and clothed with white or silvery white pile; (in the female the frons dull pollinose).......... 5.
   Abdomen not colored thus (in the female with a shining callosity on the frons, or one or more shining marks).......... 17.
5. Bristles of head and thorax yellowish white; femora yellowish; southwestern species.......... **semitaria** Coquillett.
   Bristles of head usually black, those of the thorax black.......... 6.
6. Femora yellowish.......... **bella** Kröber.
   Femora black.......... 7.
7. Pile of head and thorax entirely black.......... **pacifica**, new species.
   Pile of head and thorax largely white or yellowish.......... 8.
8. Wings hyaline or whitish, without clouded veins or dark markings.......... 9.
   Wings with veins bordered or spotted.......... 14.
9. Tips of the femora yellow; eastern species.......... **candidata** Loew.
   Femora black to the tips.......... 10.
10. Bristles of vertex and occiput yellowish white; western species. **novella** Coquillett.
    Bristles of vertex and occiput black.......... 11.
11. Frons with a hemispherical black callosity; antennae with black pile. **californica** Kröber.
    Frons without callosity, gray pollinose; antennae white pilose.......... 12.

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[10] Four species described by Kröber in his 1914 paper are not included, the writer knowing of only one species when submitting this manuscript.

12. All the wing veins black; first antennal joint slightly shorter than the third; eastern species.......... **albifrons** Say.
Costa to near tip of wing and base of Rs yellowish; western species.......... 13.
13. Knob of halteres blackish; upper forceps of genitalia long and curved. **cockerelli**, new species.
Knob of halteres white; upper forceps of genitalia not slender and curved. **vialis** Osten Sacken.
14. Knob of halteres white.......... **otiosa** Coquillett.
Knob of halteres blackish brown.......... 15.
15. Pile of frons and sides of face long and black.......... **albopilosa** Kröber.
Pile of frons yellow or white.......... 16.
16. Pile of frons yellow; small hairs of tibiae black.......... **vanduzeei**, new species.
Pile of frons white; small hairs of tibiae white.......... **niveipennis** Kröber.
17. Femora yellowish, at least on the apical third.......... 18.
Femora black to the tips.......... 24.
18. Thorax with three broad shining black stripes.......... 19.
Thorax without shining black vittae.......... 20.
19. Abdomen largely shining black; antennae black.......... **hirticeps** Loew.
Abdomen largely yellow; antennae yellowish.......... **fucata** Loew.
20. Wings thickly marked with dark brown.......... **bakeri**, new species.
Wings hyaline or with narrow borders to some veins.......... 21.
21. Frons without black pile; femora yellow to base.......... **duplicis** Coquillett.
Frons with more or less black pile.......... 22.
22. Knob of halteres yellow, western species.......... **pseudoculata**, new species.
Knob of halteres blackish or brown.......... 23.
23. Pile of abdomen white and not very long; femora yellow to base; eastern species. **flavicincta** Loew.
Pile of abdomen yellow, unusually long and dense; femora black to beyond middle; western species.......... **flavipilosa**, new species.
24. Abdomen entirely pollinose.......... 25.
Abdomen in part shining black.......... 26.
25. Abdomen brownish black pollinose; third antennal joint as long as first. **egressa** Coquillett.
Abdomen yellowish pollinose; third antennal joint three-fourths as long as first. **johnsoni** Coquillett.
26. Wings more or less clouded and marked with dark brown; veins broadly bordered with brown.......... 27.
Wings largely hyaline, the veins sometimes narrowly bordered with brown... 29.
27. Dorsum of thorax unstriped.......... **aurofasciata** Kröber.
Dorsum of thorax vittate.......... 28.
28. Abdomen with pollinose bands.......... **comata** Loew.
Abdomen without pollinose bands.......... **nebulosa** Kröber.
29. The halves of the hypandrium of the genitalia each with a rather long apical process which reaches beyond the upper forceps and is directed inward. **cingulata** Kröber.
The plates of the hypandrium with short processes.......... 30.
30. Pile of body almost entirely black; all pile of mesonotum and dorsum of abdomen black.......... 31.
Pile of body largely white or yellowish.......... 32.
31. Thorax distinctly vittate; hypandrium with very short knoblike processes. **foxi**, new species.
Thorax very faintly brown vittate; hypandrium with quite long processes. **nigripilosa**, new species.

32. Abdominal segments two to six shining black except for the narrow yellow borders, the abdominal pile black .... **brunnea**, new species.

Abdominal segments with broad pollinose areas; the venter largely pollinose; pile of abdomen largely white or yellow .... 33.

33. Venter mostly yellow and the tergites of abdomen marked with yellow; thorax with a median pure black vitta and two gray vittae....... **diversa** Coquillett.

Abdomen black in ground color; thorax not marked as above.............. 34.

34. Mesonotum dull dark brown, with two yellowish vittae; wings with no clouds on the veins.. **ustulata** Kröber.

Mesonotum gray pollinose, with two whitish vittae; wings with the cross veins clouded .... **frontalis** Say.

TABLE OF FEMALES.

1. Frons entirely pollinose, often with velvet black spots..................... 2.

Frons with a shining black callosity or with one or two shining black marks. 14.

2. Frons without any black markings...................................... 3.

Frons with velvet black markings .... 7.

3. Small, *Psilocephala*-like species; pile of the face short; frons with dense tomentumlike pile; antennae yellow with a black style; femora yellow. **semitaria** Coquillett.

Larger, more heavily built species; frons without tomentumlike pile; antennae black .... 4.

4. Abdomen largely shining black; mesonotum grayish black; black pile of fron. short and sparse................................ **borealis**, new species.

Abdomen largely gray pollinose; mesonotum gray pollinose.............. 5.

5. Frons entirely whitish pollinose and white pilose.............. **albiceps** Loew.

Frons yellowish on upper part and black pilose.......................... 6.

6. Knob of halteres largely white; reclinate pile of mesonotum yellowish. **cinerascens**, new species.

Knob of halteres blackish; reclinate pile of mesonotum white. **cockerelli**, new species.

7. No distinct frontal spots present, in certain lights a dark mark next the eye margin; femora yellow .... **bella** Kröber

Frontal spots larger and distinct; femora black.......................... 8.

8. Frontal markings consist of two round, velvet black spots................ 9.

Frontal markings in the form of a crossband, interrupted or entire......... 11.

Frontal markings consist of two triangular, velvet black spots, one on each side. **nitoris** Coquillett.

9. Wing veins marked or bordered with brown; western species. **otiosa** Coquillett.

Wing veins not bordered with brown.................................. 10.

10. First antennal joint about as wide as the third; western species. **vialis** Osten Sacken.

First antennal joint much thicker than the third; eastern species. **bimaculata**, new species.

11. Bristles of vertex and occiput yellowish; thorax without black pile. **novella** Coquillett.

Bristles of occiput and vertex black.................................. 12.

12. Wing veins pale yellow; eastern species................... **candidata** Loew.

Wing veins black or brown; western species............................ 13.

13. Wings whitish hyaline, with no clouds on veins; pile of face and thorax white. **pacifica**, new species.

Wings with clouded cross veins; pile of face and thorax yellow. **vanduzeei**, new species.

14. Frons shining black except for silvery lower corners; small *Psilocephala*-like species.. **pygmaea**, new species.
Frons with the pollen more extended; larger and more typical species..... 15.
15. Frons with one shining black spot, usually cordate and convex............ 16.
Frons with two shining black marks.. 24.
16. Femora black... 17.
Femora yellow or brownish yellow.. 20.
17. Upper two-thirds of frons entirely shining black............... **strigipes** Loew.
Black of the frons reduced to a smaller area by the pollen................. 18.
18. The brown areas of mesonotum appearing as three broad, dark-brown vittae; frons dark-yellow pollinose........................ **brunnea**, new species.
The mesonotum more gray in color; pollen of the face yellowish gray...... 19.
19. Thorax with the markings pale; scutellum gray pollinose; western species, pile of face white... **cingulata** Kröber.
Thorax with markings pale; scutellum with brown spot; pile of face yellowish. **neomexicana**, new species.
Thorax with three distinct dark vittae; scutellum with a brownish spot at the base; eastern species, face white pilose...................... **frontalis** Say.
20. Thorax with three broad shining black vittae.............................. 21.
Thorax without shining black vittae....................................... 22.
21. Abdomen largely yellow; first antennal joint yellow............. **fucata** Loew.
Abdomen largely shining black; first antennal joint black..... **hirticeps** Loew.
22. Wings marked with dark brown; dorsum of abdomen largely yellow; thoracic vittae dark.. **bakeri**, new species.
Wings almost hyaline, dorsum of abdomen largely black.................... 23.
23. Frontal callosity separated from the lower ocellus by pollen; thorax with a median black stripe...................................... **diversa** Coquillett.
Frontal callosity reaching the lower ocellus; thorax without median black stripe; eastern species... **flavicincta** Loew.
24. The shining black spots of frons projecting in two hemispherical, eyelike knobs. **pseudoculata**, new species.
The frontal callosities not projecting thus................................. 25.
25. Femora yellow or largely yellow... 26.
Femora black... 27.
26. Femora wholly yellow; first antennal joint black.......... **duplicis** Coquillett.
Front femora black except apex, the hind femora black basally; first antennal joint yellow..................................... **flavicauda** Coquillett.
27. The shining transverse frontal spots wider than the antennae and almost touching in the middle; cross veins narrowly bordered brown.................... 28.
Frontal spots very narrow; wings densely mottled with brown.............. 29.
28. Third antennal joint three-fourths as long as the first; abdomen yellowish brown pollinose; last two segments shining brown............. **johnsoni** Coquillett.
Third antennal joint about as long as first; abdomen blackish brown pollinose; last two segments shining blackish....................... **egressa** Coquillett.
29. Abdomen with pollinose bands..................................... **comata** Loew.
Abdomen without pollinose bands.......................... **nebulosa** Kröber

THEREVA PYGMAEA, new species.

Plate 10, fig. 127; plate 11, figs. 143, 144; and plate 12, fig. 165.

Male.—Length 5.5 mm. A small *Psilocephala*-like species, largely shining black. Head black, the eyes contiguous for only a short distance; upper corner of the frontal triangle without pollen, the rest of the frons silvery white and with long black pile. Face silvery white pollinose and largely white pilose, the outer margin with black pile, this black pile reaching to the black mark on the cheeks and crossing it on the underside of the head. Mouth parts blackish with white pile. Occiput silvery gray pollinose, thinly so in the median portion above, the pile white, post-ocular bristles black and slender. Antennae black, the first joint about the length of the third (fig. 143), with white pile and black bristles; third joint with minute hairs at the base and a short style; first two joints gray pollinose.

Thorax semishining black, with two very distinct widely separated whitish vittae; pile of mesonotum largely erect, blackish, white around the margins; scutellum shining black with a silvery pollinose margin, four marginal black bristles, the pile white. Pleura and coxae gray pollinose and white pilose. Bristles of the thorax long and black. Halteres blackish, the stem paler.

Abdomen shining black; first segment dull, second segment semishining on the base, the rest of the dorsum silvery pollinose as in many species of *Psilocephala;* sides of segments beyond the third shining black. Venter shining black, the first segment gray pollinose, the second and third with silvery pollinose posterior margins. Genitalia black, small (fig. 144), the pile almost entirely black. Pile of the abdomen long and white on the first segment and sides of the others, on the dorsum reclinate and confined largely to the posterior margins. Femora black, the front legs entirely black, or reddish at the base of the tibiae; the four hind tibiae except apices reddish; four hind tarsi reddish at base, black beyond. Wings hyaline, the veins blackish brown, stigma brown, cell M-3 closed and petiolate.

Female.—Length 6 to 7 mm. Very nearly like the male. Frons wide below, narrow above, largely shining black, including the vertex and ocellar tubercle, smooth, gently convex, the lower corners silvery as in some species of *Psilocephala* (fig. 127); there are a few black hairs on the vertex and across the frons above the antennae. Pile of the head colored as in the male but shorter, black mark on the cheeks broader.

Thorax and scutellum much as in the male, the pile much shorter; the mesonotum with short golden tomentumlike pile, the reclinate pile on the scutellum silvery white. Abdomen shining black, the first segment gray pollinose on sides and venter, the second and third segments with narrow silvery posterior borders, the fifth segment with large lateral silvery pollinose spots. Pile on the first three segments very sparse, largely on the posterior margins; some black pile on the sides of the third, from the fourth segment on black erect pilose, the pile longer than is usual in the species of *Thereva* and *Psilocephala*. Posterior margins of second and third ventral segments silvery pollinose, the rest of the venter shining black. Wings hyaline or with a grayish tinge.

Type locality.—Glen Martin, in the San Bernardino Mountains, San Bernardino County, California, August 16, 1920 (F. R. Cole).

Type.—Male, Cat. No. 25935, U.S.N.M.; allotype, female, in same.

This species in some ways forms a connecting link between *Psilocephala* and *Thereva*. By reason of the hairy face it would be classed with the genus *Thereva*, and yet it has many characters in common with the *haemorrhoidalis* group in *Psilocephala*, the frons of the female resembling some of the species in that group; like the males in that same group, the abdomen is rather flattened and silvery pollinose above. Perhaps the writer is too conservative, but for the present it seems best to hold to the old character of the bare or pilose face for distinguishing the genera *Thereva* and *Psilocephala*.

The species described above was collected along the edges of a small stream. Although very quick in their movements these flies are sometimes easily caught while they are rummaging about in the drift trash at the edge of the water. Like many other Therevids their normal flight is hoplike and for short distances only.

Paratypes.—There are 10 males and 15 females, taken by the writer at Glen Martin, the type locality, from August 7 to 20. One paratype, taken at Shasta Springs, July (C. L. Fox), in the California Academy of Sciences.

THEREVA ANOMALA Adams.

1904. *Thereva anomala* ADAMS, Kans. Univ. Sci. Bull., vol. 2, p. 444.

The species is said to resemble some species of *Psilocephala* in general appearance. It has two brown crossbands on the wing. The length is given as 9 to 10 mm.

Type locality.—Oak Creek Canyon, Arizona.

Types.—In the Kansas University collection.

THEREVA MELANONEURA Loew.

Plate 10, fig. 125; plate 11, fig. 145; and plate 12, fig. 156.

1872. *Thereva melanoneura* LOEW, Berlin. Ent. Zeitschr., vol. 16, p. 74.

Type locality.—California.

Type.—In the Museum of Comparative Zoology at Cambridge.

This is another *Psilocephala*-like species, with dense silvery white pollen on the dorsum of the abdomen in the male.

A male specimen from New Mexico loaned by C. W. Johnson but for the hairy face would be placed in *Psilocephala*. The hair of the frons and face is as long or longer than the first two antennal joints combined. The middle of the frons is very thinly pollinose, semishining. There is no black pile on the antennae. The first abdominal segment is gray pollinose, the sides of the second semishining. The upper forceps of the genitalia are largely black. The genitalia are figured on plate 11.

A female sent with the above specimen was taken in the same locality. The female is strikingly different from the male and is described below:

Female.—Length 7.5 to 8.5 mm. Head black, frons with a few short black hairs and a line of black pile on upper side of face and outer margin, the rest of the face, cheeks, and occiput with long white pile. Occiput and face gray pollinose, the post-ocular bristles black. Two very large, round, shining black calli on lower half of frons (fig. 125); upper half of frons and vertex flat, brownish gray pollinose. Antennae black with black bristles, more or less gray pollinose, especially the first two joints, the first joint slightly longer than the third and with white pile on the basal half.

Thorax opaque grayish black, reclinate whitish pilose and with some erect brownish pile. Mesonotum with two faint gray stripes. Scutellum colored like the thorax, with reclinate white pile and four black bristles. Pleura and coxae black, gray pollinose, white pilose. Halteres blackish, including the stem.

Abdomen largely shining black, the first two segments thinly white pilose, the other segments short, erect, rather dense black pilose; second segment with a distinct white border, a very narrow one on the third segment; second and third segments more or less gray pollinose on sides and posterior margins, gray pollen above on the fifth. Venter gray pollinose, thinly so beyond the fourth segment, black pilose beyond the second. Tibiae and first tarsal joints except the apices yellowish red, the legs otherwise black, with black bristles; femora with reclinate silvery white pile and some erect white pile, more dense on the front pairs; front and middle femora with three bristles below. Wings hyaline, the veins heavy and black, the stimga brown; r–m cross vein faintly clouded, cell M–3 closed and petiolate. (Fig. 156.)

Neallotype.—Female, collected at Alamogordo, New Mexico, May 5, 1902, No. 663 [A. N. S. P].

Specimens examined.—One male, three females.

The four specimens seen by the writer were all from New Mexico. The sexes are so different that until they are actually taken together there will be some doubt as to their belonging to the same species. Coquillett records taking 10 specimens at Kukak Bay, Alaska, and Kröber records the species from southern Colorado.

THEREVA SEMITARIA Coquillett.

Plate 10, fig. 128, and plate 11, fig. 138.

1893. *Thereva semitaria* Coquillett, Can. Ent., vol. 25, p. 198.

The species more nearly resembles *Psilocephala acuta* and *P. marcida* than any of the species of *Thereva*, the eyes being shaped as in *acuta*. In the female the frons and face has reclinate, tomentum-like pile; the antennal style is black. The vittae of the thorax are dark gray, indistinct. The only specimen examined by the writer was a female collected at Bradley, California, May 23 (E. P. Van Duzee), in the California Academy of Sciences. This specimen has the front femora partially brownish. The veins toward the base of the wing are yellowish, blackish beyond, the stigma black.

Type locality.—Southern California.

Type.—Male, No. 10421, U.S.N.M.

THEREVA OTIOSA Coquillett.

Plate 10, fig. 124; plate 11, fig. 141; and plate 12, fig. 167.

1893. *Thereva otiosa* Coquillett, Can. Ent., vol. 25, p. 199.

This species is closely allied to *vialis* and *candidata*. The wings are grayish hyaline, with narrowly bordered veins. (Fig. 167.) The frontal spots of the female are quite large. (Fig. 124.)

Type locality.—Los Angeles County, California.

Types.—Male, No. 10423, U.S.N.M.

The outer covering of the male genitalia is gray pollinose, the general shape as in *vialis* Osten Sacken. In the females examined the thorax was gray pollinose, marked with brown; there is a broad median brown stripe hardly reaching the scutellum and with a faint gray longitudinal dividing line, on either side a broad brown stripe or mark, broadest above the wing base and not reaching to the humeri or scutellum. The first seven abdominal segments are gray pollinose, the very narrow base of the second, third, and fourth brown on the sides; the pile is short, sparse, and whitish.

Distribution.—The two males and two females examined were from the following localities: California—Claremont (Baker), [Pomona College]; Shasta County (Edwards), [Amer. Mus.]; Crafton, San Bernardino County (Osten Sacken), [M. C. Z.].

THEREVA NOVELLA Coquillett.

Plate 11, fig. 139.

1893. *Thereva novella* Coquillett, Can. Ent., vol. 25, p. 200.

The original description by Coquillett is as follows:

> *Male.*—Same as *otiosa*, with these exceptions: Style of antennae two-fifths as long as the third joint; pile and bristles of vertex and bristles of occiput yellowish white;

thorax destitute of black pile; knob of halteres brown, margined with yellow; veins of wings largely yellow, stigma also yellow and indistinct.

Female differs from the female of *otiosa*, besides in the particulars above mentioned, in that the front is destitute of the two round velvet black spots, having instead a narrow, interrupted, dark-brown crossband; eighth abdominal segment opaque pollinose, its pile largely yellow.

Length 8 to 11 mm. Los Angeles County, California. Five males and one female.

C. W. Johnson very kindly loaned the only two specimens of this species in his collection; these were the only specimens available for examination. Both are males, one labeled "Colo. no. 1836" and the other "Ft. Collins, Colo., VIII, '00." The first specimen lacks the third joint of each antennae and is scarcely distinguishable from the male of *candidata*, the bristles of the occiput being black. The other specimen is about 11 mm. in length and has a very characteristic third antennal joint, the base bulbous and black, the apical half very slender and yellow, with a short black arista (fig. 139); the first joint is shorter than the third, white pilose, and with a few black bristles at the tip. The specimen has been wet and considerably rubbed. The knob of the halteres is not black at the base as in *candidata*, but yellowish. Vein R 1 is brown, the other veins yellow. The femora are black to the tips.

THEREVA VIALIS Osten Sacken.

Plate 10, fig. 129; plate 11, figs. 140 and 147; and plate 12, fig. 158.

1877. *Thereva vialis* OSTEN SACKEN, Bull. U. S. Geol. Surv., vol. 3, p. 274.

This common western species was described from males only. It is very near *candidata* Loew of the Eastern States, but differs in having black pile near the antennae, the femora black to the tips, and the wing veins darker.

Type locality.—Yosemite Valley, California.

Type.—In the Museum of Comparative Zoology at Cambridge.

Allotype.—I have designated as a neallotype a specimen taken at Stanford University, April 30, 1920 (Cole). This specimen is deposited in the United States National Museum.

Female.—Length 8 to 10 mm. Upper two-thirds of frons yellowish brown pollinose, with two large rounded velvet black spots, which almost touch in the middle (fig. 129); lower frons and face silvery white pollinose; the pile of upper frons short, black, that of the lower frons, face, first antennal joint, and occiput yellowish. Antennae black, the first joint about as long as the third, the style short; first and second joints gray pollinose. Occiput white pollinose, the pile of lower occiput and cheeks white.

Thorax black, the mesonotum dark-gray pollinose, with two pale vittae, yellowish reclinate pile and a few erect black hairs. Scutellum and pleura gray pollinose, center of scutellum darker; pile of scutellum yellow, the four marginal bristles black, the middle pair close together and crossing; pile of upper pleura yellowish, the rest of the pile, including that on the coxae, white. Stem of the halteres blackish gray, the knob yellowish.

Abdomen black, gray pollinose, with a yellowish tinge on the dorsum; pile of dorsum pale yellowish, longer on the first segment, more or less reclinate on the first three segments, on the following segments short and erect; eighth segment and genitalia shining blackish and short erect black pilose, the circlet of bristles black. Short pile of venter erect and white. Femora with tomentumlike silvery white pile and erect white pile, only a few erect hairs on the hind femora near the base. Cell M-3 closed and short petiolate or very narrowly open in the margin of the wing. (Fig. 158.)

Distribution.—The species has been recorded from Oregon, California, Washington, and North Carolina. The North Carolina record given by Kröber is undoubtedly erroneous, the form referred to being a new species described in this paper as *bimaculata*. Twenty-six males and fourteen females were examined from the following localities:

Canada: Savary Island, British Columbia, June 30 to August 14 (R. S. Sherman), [Sherman]; Buccaneer Bay, British Columbia, July 17 (R. C. Treherne); Kamloops, British Columbia, May 25 (W. B. Anderson), [Canad. coll.]; Nanaimo, British Columbia, June 28 (E. P. Van Duzee), [Cal. Acad. Sci.].

Oregon: No other data (Edwards), [Amer. Mus.]; Hood River, June 2 to 20 (Cole), [Cole].

California: Fresno County (Edwards), [Amer. Mus.]; Blue Lake, Humboldt County, June 20 (Bradley); Alta Meadows, Sequoia National Park, 9,000 feet, July 19 (Bradley), [both Cornell]; Kern County [Kans. U.]; Shasta Springs, June 13 (C. L. Fox); Bradley, Monterey County, May 23 (E. P. Van Duzee), [both Cal. Acad. Sci.]; Los Angeles, April 3 (M. C. Van Duzee); Los Cerritos, Los Angeles County, April 3 (M. C. Van Duzee); Portola, June 5 (M. C. Van Duzee), [all Van Duzee]; Palo Alto, April 30 to June 10 (Cole); Redlands, May (Cole), [both Cole]; Santa Cruz Mountains, May (W. M. Mann), [R. C. Shannon].

THEREVA CALIFORNICA Kröber.

1912. *Thereva californica* KRÖBER, Entom. Zeitung, vol. 73, p. 259.

The following is a translation of the original description:

Male.—In the group *otiosa*. Face silvery white, with white pile. Frontal triangle black, semishining. The middle has a hemispherical shining black callus. Antennae black, with black pile. Occiput through tomentum whitish gray, with snow-white pile. Thorax shining black, with whitish gray pollen and white pile. Scutellum like the thorax. Pleura weak gray pollinose, sparse white pilose. Abdomen thickly white pilose without noticeable silvery shine. Second to fourth segments with white posterior borders. Anal segment spherical, prominent, black, shining. Venter through pollen whitish gray, with white pile and pure white borders on segments two to four. Femora black, through pollen and white pile appearing gray. Tibiae light yellowish brown, with darkened tips. Tarsi black, with yellowish brown base. Wings whitish, not hyaline, with strong, dark-brown veins and blackish brown stigma. The fourth posterior cell is closed. Length 8.5 mm.

Type.—In Kröber's collection.

Type locality.—California.

THEREVA CANDIDATA Loew.

Plate 10, fig. 130, and plate 11, fig. 149.

1869. *Thereva candidata* LOEW, Berl. Ent. Zeitschr., vol. 13, p. 8.

Male.—Length 8.5 mm. Head black, white pollinose and with white pile on the lower frontal triangle, face, cheeks, and occiput; post-ocular bristles black. Mouth parts brown with white pile. First joint of antennae and base of second black, gray dusted, the first with black bristles near the apex and white pile; third joint yellowish, darker at the base, the arista black.

Thorax black, gray pollinose, the mesonotum dark gray, with two whitish vittae, broad anteriorly and posteriorly; the lateral margins of mesonotum light gray; pile of mesonotum erect, whitish, the bristles black. Scutellum gray pollinose, darker at the base, with long erect white pile and four black marginal bristles. Pleura and coxae silvery white pollinose and white pilose. Stem of halteres yellowish brown, base of the knob black, the rest yellow.

Abdomen black, dense gray and white pollinose, with white pile, dense and reclinate on the dorsum; base of second, third, and fourth segments with a round black spot near the middle. The hypopygium largely black, white pollinose and pilose, the outer margin of the upper forceps yellow, the hypandrium small. (Fig. 149.) Femora black, the tips broadly yellow, pile white; tibiae yellow, the extreme apices darkened; the last two tarsal joints blackish brown, the rest yellow with brown apices. Bristles of the legs black. Wings hyaline, all the veins yellow, the stigma pale yellow; cell M-3 usually wide open.

Female.—Length 10 mm. Darker than the male as a rule. Upper two-thirds of frons golden brown pollinose, the lower third silvery white; on each eye margin near the junction of the two colors a semicircular brown spot, visible only in certain lights (fig. 130); upper part of frons with short black pile, pile on the lower part and the face silvery white. Antennae black, the first joint and base of the second gray pollinose. Scutellum with short yellow pile. Mesonotum with short erect blackish pile and reclinate whitish pile.

Abdomen gray pollinose, base of second segment broadly black, semishining; third, fourth, fifth, and sixth segments with narrow black basal bands, the pile on these bands brownish, the rest of the abdominal pile short and whitish. In most specimens there is a round black spot projecting beyond the basal black band of segments two to six. Genitalia largely blackish, with short yellow pile and a yellow circlet of bristles. Wings often yellowish; cell M-3 closed or narrowly open.

Type locality.—Northern Wisconsin.

Type.—A male, in the Museum of Comparative Zoology at Cambridge.

Distribution.—The distribution according to 33 males and 19 females is:

Canada: Truro, Nova Scotia, July 4 (R. Matheson), [Cole]; St. Johns, Quebec, May 10 [Kans. U.]; Aweme, Manitoba, July 9 (Criddle). [A. N. S. P.]; Coulonge, Quebec, July 28 (J. L. Beaulne); Landraie, Quebec, June 20 (J. L. Beaulne), [both Canad. coll.]; Ridgway, Fort Erie and Kearney, Ontario, June 1 to July 20 (M. C. Van Duzee), [Van Duzee].

Maine: Norway (S. J. Smith), [M. C. Z.].

Connecticut: No other data (Loew), [M. C. Z.].

New Hampshire: White Mountains (Scudder), [M. C. Z.]; Bretton Woods, June 30 (M. C. Van Duzee), [Van Duzee].

New York: North Elba, July [Amer. Mus.]; Essex County, August (F. M. Jones), [Harrisb. coll.]; Lancaster, May 3 to June 28 (M. C. Van Duzee), [Van Duzee].

Pennsylvania: Enterline, July 3, and Harrisburg, June 26 [Harrisb. coll.].

District of Columbia: No data (Loew), [M. C. Z.].

Virginia: Near Plummer Island, June 2 (McAtee), [Biol. Surv.].

Maryland: Plummer Island, May 30 (R. C. Shannon), [Shannon].

Ohio: Medina, May 24 (J. S. Hine), [Hine].

Michigan: "Mich." (Wheeler), [Amer. Mus.]; Agr. College, July 12 to 31 [Cornell].

Wisconsin: Cranmoor, August 5 (Hardenburg), [Harrisb. coll.].

Minnesota: Beltrami County, August 2 to 9; Chicago County, July 16; Ramsey County; Olmsted County, June 23 [all Minn. U.].

THEREVA CINERASCENS, new species.

Female.—Length 9.5 mm. A black, gray pollinose species, closely resembling the female of *candidata* Loew. Frons on upper three-fourths pale brownish pollinose, with short black pile, the lower fourth of frons and face silvery white pollinose and white pilose. Occiput white pollinose and pilose, the pile on upper part yellowish. Antennae black, first two joints gray pollinose; first joint about as long as the third; black bristles of first joint rather long.

Thorax gray pollinose, dark on the mesonotum, with two whitish vittae, the margins also paler; mesonotum with short reclinate yellowish pile and erect black pile. Pleura dense whitish gray pollinose, thickly white pilose. Scutellum with a dark-gray spot at base, the margin paler, the pile reclinate yellowish; four black bristles on the margin. Knob of halteres whitish, the base black, and stem brownish.

Abdomen black, gray pollinose or yellowish gray; pile on the first five segments white or yellowish reclinate from the third to the fifth, the sixth, seventh, and the genitalia short erect black pilose. Second segment with the base broadly blackish, narrower on the third, fourth, and fifth; segments four to seven with a narrow black posterior margin, wider in the middle and connected with the base of the segment by a faint black line. Genitalia shining black. Femora black; knees, tibiae except tips, and base of tarsi yellow, the last tarsal segments and tip of first black. All bristles of the legs black. Wings gray hyaline, the costal vein, R-1, and base of wing yellowish, the rest of the veins blackish; cell M-3 closed in the margin or narrowly open.

Type locality.—Hood River, Oregon, June 13, 1917 (F. R. Cole).

Type.—Female, Cat. No. 25936, U.S.N.M.

Paratypes.—In addition to the type, two females were examined, both specimens in the collection of R. S. Sherman of Vancouver, British Columbia; the specimens were collected at Savary Island, British Columbia, July 18, 1917, by Mr. Sherman.

The male is probably very near the male of *candidata* and *vialis*. The antennae are not the same as in *candidata* and there is more black pile on the frons, darker wing veins and different abdominal markings; the femora are black to the tip.

THEREVA BIMACULATA, new species.

Female.—Length 8 mm. Very nearly like *T. vialis*. Upper two-thirds of frons pale brown, with two large velvet black spots which almost meet in the middle; the lower third of frons silvery gray and with a few short hairs. Antennae black, the first joint quite thick and with only a few apical bristles, white pilose, slightly longer than the third joint. Face silvery white pollinose with white pile; palpi and proboscis with white pile; occiput whitish, with white pile and black bristles.

Thorax and pleura black, covered with gray pollen, the pile short and white. In the somewhat poorly preserved type no markings are visible; in a perfect specimen there is probably more or less brownish pollen on the thorax. Knob of the halteres pale yellowish, the stem and base of knob brownish.

Abdomen black, brownish and gray pollinose, with short sparse while pile; last segment shining brownish black. Femora blackish brown, white pilose, the apices yellowish, as are the tibiae and tarsi; tibiae and tarsal joints with the apices brownish. Wings whitish hyaline, the stigma yellowish, the veins brown and yellowish; cell first A closed near the margin and M-3 closed in the margin.

Type locality.—Southern Pines, North Carolina, April 4, 1906 (S. W. Foster), [Cornell].

Type.—Female, in the Cornell University collection.

Paratypes.—The species should be easily recognized, and for this reason it is described from the poorly preserved type material. There are two female paratypes in the Cornell collection, taken in the type locality April 11, 1906. The facial spots are larger than in *vialis* and the antennae different, but it has undoubtedly been confused with this species by Kröber, who records *vialis* from North Carolina.

THEREVA ALBOPILOSA Kröber.

1912. *Thereva albopilosa* KRÖBER, Stett. Ent. Zeit., p. 256.

The following is a translation of the original description:

> *Male.*—Belongs to the group *otiosa* on account of the white abdominal pile. The pile is, however, not silvery white throughout, and the ground color is clearly perceptible. The pile is very long and woolly. Face dense white pilose, so that the ground color is not visible. Frons with delicate, long, black pile, which reaches down to the lower corner of the eye. Antennae black; third joint brownish. Occiput whitish gray. Crown of bristles standing up from blackish brown, very long pile. Pile otherwise white, long, and wooly. Thorax opaque, without luster, through the mixed brown and white pile appearing peculiar gray, with two yellowish gray, indistinct, longitudinal stripes and a broad, blackish brown, median stripe. Pleura very thickly woolly white pilose. Halteres blackish brown, the stem somewhat lighter. Scutellum gray pollinose, white pilose. Abdomen in ground color black, almost opaque. Second to fifth segments with whitish yellow borders. Second to sixth with very broad yellowish gray pollinose bands. Seventh and eighth segments dull dark brown. Pile unusually long, pure white, on the reddish yellow anal lamellae yellowish. Venter yellowish gray pollinose. Second to fifth segments with yellow borders. Pile long, white. Femora blackish brown, with white pile; tibiae and tarsi yellowish brown, the tips somewhat darkened. Wings hyaline. Veins strong brown, the cross veins somewhat clouded. Stigma dark brown, large, deep colored. The fourth posterior cell closed. Length 12 mm.

Type locality.—Colorado.

Type.—Male, in Kröber's collection.

THEREVA COCKERELLI, new species.

Plate 11, fig. 146.

Male.—Length 9 mm. Head black, the frons and face dense silvery white pollinose and white pilose. Antennae black, with black bristles; the first two joints gray pollinose, the first joint with white pile on the basal half; style about one-fourth as long as the third joint; third joint about as long as the first. Palpi black, white pollinose, and white pilose, with black bristles.

Thorax, pleura, and scutellum black, dense gray pollinose; pile of mesonotum mixed white and black, the bristles black; two whitish vittae, a faint brown median stripe and pale brown margining the white vittae on the outside. Posterior mesonotum and scutellum long white pilose, the scutellum with four black bristles. Pleura white pilose. Stems of halteres yellowish, the knob black, gray pollinose.

The black ground color of the abdomen entirely concealed by whitish gray pollen, the dorsum with long silvery white pile; pile of venter shorter and not so dense. Genitalia characteristic in form, mostly white pilose, a few black hairs on the hypandrium; the upper claspers long and curved. (Fig. 146.) Femora black, gray pollinose, white pilose; no bristles on front and middle femora, the bristles of legs black; tibiae yellowish except tips; first tarsal joint yellowish at base, the other joints black. Wings hyaline, the stigma brown, veins black except at base of wing and along costa; cell M-3 closed; a short stump of a vein near the furcation of Rs in the type.

Female.—Length 10.5 mm. Very nearly like the male. Body entirely pollinose and almost wholly gray. (Frons and mesonotum slightly greased.) Frons dull pollinose, the upper part apparently brownish gray, the lower third silvery gray pollinose; pile of upper frons and vertex black, all the rest of the pile of the head white.

Pile of mesonotum largely short, reclinate, and white, but there are a few short black pile in the median portion. Abdomen black in ground color and almost wholly gray pollinose; on the second, third, and fourth segments a basal, dark-brown, semicircular mark, narrow on the sides and divided by a median grayish line; first four segments with short reclinate white pile, the rest of the abdomen with short erect black pile. Wings gray hyaline, with cell M-3 wide open in both wings of the type specimen.

Type localities.—Peaceful Valley, Colorado, and Aweme, Manitoba, Canada. Holotype, a male, collected at Peaceful Valley, Colorado, August, 1919 (T. D. A. Cockerell), and allotype, a female, collected at Aweme, Manitoba, Canada, June 13, 1911 (E. Criddle).

Types.—Holotype in the United States National Museum, Cat. No. 25937. Allotype in the Philadelphia Academy of Natural Sciences.

There is a male paratype in the Academy of Natural Sciences in Philadelphia collection, taken with the allotype at Aweme, Manitoba. The species is closely related to *candidata*, *cinerascens*, and *vialis*. The male is easily recognized by the peculiar structure of the genitalia. It is evidently a northern form and may have a rather wide distribution.

THEREVA BELLA Kröber.

Plate 11, fig. 137.

1914. *Thereva bella* KRÖBER, Beiheft z. Jahrb. Hamb. Wiss. Anstalten, vol. 31, p. 64.

Male.—Length 9.5 mm. Head black; frontal triangle and face silvery white pollinose and white pilose, the pile rather sparse. Antennae blackish brown, the tip of the second and base of the third joint yellow; third joint slightly longer than the first (fig. 137); first joint with black bristles and white pile. Palpi yellow, with white pile; proboscis largely yellow. Occiput white pollinose and pilose, the post-ocular bristles black. Pile on the ocellar tubercle black.

Mesonotum gray pollinose, the anterior and lateral portions paler, with faint indications of two light gray vittae; the pile is reclinate, golden yellow, and erect, black, and whitish, whitish on the margins. Thoracic bristles black. Scutellum gray pollinose, the base darker, with yellowish pile and four black marginal bristles. Pleura gray pollinose and white pilose, the pile near the wing base yellowish. Halteres yellow, the base of the knob brown.

Abdomen more or less reddish yellow in ground color, thinly gray pollinose and silvery white pilose. The venter and genitalia almost wholly reddish yellow, the pile on the genitalia more yellowish. On the dorsum of the abdomen a dark-brown or blackish spot at the base of the second to the fifth segments and near the middle. Structure of the genitalia near that of *candidata*, the upper portion projecting some distance beyond the hypandrium. Coxae and trochanters black, the former gray pollinose; legs almost wholly yellow, the tips of tibiae, apices of first three tarsal joints, and all of the last two tarsal joints blackish; empodia yellowish. Pile of femora sparse and white; legs with black bristles, the small setulae of tibiae and tarsi yellow. Wings hyaline, with a yellowish tinge, the veins and stigma yellow; cell M-3 open in the margin.

Female.—Length 8 to 10.5 mm. Very closely resembling the male, but the body more golden yellow pollinose than gray. Upper two-thirds of frons golden brown pollinose and short black pilose; lower frons and face silvery gray pollinose and golden yellow pilose. Pile of first antennal joint largely black.

Mesonotum slate-gray pollinose, with a rather dense covering of short tomentumlike golden pile, the short erect pile black. Base of scutellum slate gray, the margin paler, the pile golden yellow. Pleura gray pollinose, the pile mixed yellow and whitish.

Abdomen blackish in ground color, bright golden yellow pilose, the base of second and third segments broadly dull black, narrower on the fourth; the fourth and fifth with a median basal black spot; eighth segment shining blackish brown, the terminal circlet of spines reddish yellow and quite long. The legs as in the male, in one specimen with some blackish color on the femora. Wings with cell M-3 widely open.

Type.—In Kröber's collection.

Distribution.—Three males and three females were examined, from the following localities:

Massachusetts: Sharon, August 25 [B. S. N. H.].

Connecticut: Waterbury, September 26, "on foliage" (C. H. T. Townsend), [U.S.N.M.].

Rhode Island: Kingston, July 20 [C. W. Johnson].

New Jersey: Delaware Water Gap, July 15 [C. W. Johnson]; Ridgewood, August 8 (M. D. Leonard), [R. C. Shannon].

Pennsylvania: Allegheny County, Jeanette [both Carnegie Mus.]

THEREVA ALBIFRONS Say.

1829. *Thereva albifrons* SAY, Journ. Nat. Sci. Phila., vol. 6, p. 156.

Coquillett considered *albiceps* Loew the same as *albifrons*, and some other dipterists have come to this conclusion, with which I can not agree. C. W. Johnson has loaned a specimen of what is taken to be *albifrons* Say. The specimen is described below:

Male.—Length 9.5 mm. Black, largely gray pollinose and white pilose. Antennae rather short and thick; the first joint a little wider than the third and scarcely as long, the style short and blunt; second joint considerably narrower than either the first or third. Bristles of the antennae black, the pile white. Upper corner of frontal triangle and a narrow line between the eyes dull black, the rest of the frons white pollinose and pilose. Face, cheeks, and occiput white pollinose and pilose. Post-ocular bristles black. Palpi and proboscis black, with white pile.

Thorax black, gray pollinose and thinly white pilose. The mesonotum is slightly greased in the specimen described, but there are evidently two narrow, widely separated white vittae and a darker median stripe. Scutellum black, gray pollinose and white pilose; there are evidences of only two marginal bristles. All the thoracic bristles black. Pleura gray pollinose and white pilose. Halteres largely yellowish, the base of the knob blackish.

Abdomen black, densely gray pollinose and silvery white pilose, the pile longer and more erect on the sides of the first three segments. Second and third segments with a white posterior margin. Venter like the dorsum. Genitalia rather small, black, the upper forceps gray pollinose and with a narrow yellow margin; the hypandrium very short. Coxae all gray pollinose and white pilose. Femora black, gray pollinose and with rather short white pile. Knees and most of tibiae and tarsi brownish yellow, the apices of tibiae and tarsi blackish. Bristles of the legs black. Wings hyaline, the veins blackish brown and strong; stigma brown; cell M-3 open but narrowed in the margin.

The specimen described was taken at Springfield, Massachusetts, May 19, 1915 (R. T. Webber), and is in the collection of the Boston Society of Natural History.

Type locality.—Indiana.

Type.—Not in existence.

THEREVA ALBICEPS Loew.

1869. *Thereva albiceps* LOEW, Berlin. Ent. Zeit., vol. 13, p. 166.

A gray, white pilose species, the head wholly snow-white, antennae black. Differing from *candidata* in having the knob of the halteres brownish black. Abdomen of male white pollinose and pilose. Loew gives British America (Scudder) and Red River (Kennicott) as the habitat.

Type localities.—"British America and Red River."

Types.—In the Museum of Comparative Zoology at Cambridge.

Through the kindness of Mr. Nathan Banks, of the Museum of Comparative Zoology at Cambridge, I am able to establish the identity of this species. One specimen, a female, was loaned from the collection of the Museum. This unidentified specimen was from the Loew collection and bears the label "British America, Scudder." One of Loew's types had this same label and, as the original description fits the specimen examined, there seems to be no doubt of the identification. The following notes are made from the examination of the specimen:

The third joint is missing from both antennae, but the first joint differs from that of *albifrons*, being longer and more slender, not much wider than the second joint. There are three dark-gray vittae on the mesonotum, or areas set off by two widely separated longitudinal white stripes; on the outer side of the white stripes there is a line of brownish pollen. There are four scutellar bristles. Stem of the halteres brownish yellow, the knob blackish brown. The pile of the abdomen is sparse and white on the first three segments, short, erect, and black on the others. The abdomen is as described by Loew, the second, third, and fourth segments with the broad basal brown mark divided by a gray median line. The wings are whitish hyaline, the veins yellowish on the basal third.

THEREVA PACIFICA, new species.

Plate 11, fig. 133.

Male.—Length 8 mm. Head and appendages black, with black pile and bristles; pile of lower occiput and cheeks dense. Third joint of antennae slighty shorter than the first and quite slender, narrower than the first or second, the arista short (fig. 133); first two joints of antennae, base of third, face, and most of occiput gray pollinose; upper corner of frontal triangle velvety black.

Thorax, scutellum, and coxae dull black, thinly gray pollinose and black pilose; black pile of anterior part of thorax and the scutellum dense and erect. Halteres blackish, the knobs gray pollinose.

Abdomen black, gray pollinose and silvery white pilose; pile on first segment erect white, silvery on the posterior margin, the rest of the pile on the dorsum reclinate and dense. Hypandrium black and densely pilose, some of the hairs black; the structure of the genitalia close to *vialis* Osten Sacken. Venter very sparsely pilose. Legs with black bristles. Femora black, black pilose; most of tibiae and base of tarsi yellowish, the tip of tibiae and most of tarsi black. Wings whitish hyaline, veins brown, stigma narrow and brown, cell M–3 closed and short petiolate.

Female.—Length 9 mm. Quite different in general appearance from the male. Antennae about the same in structure, the pile at the base of the first joint white. Bristles of antennae and occiput black. Upper frons with short black pile, a few black hairs on the lower frons; lower frons and face silvery white pollinose, the former largely white pilose, the latter entirely so; upper frons grayish brown pollinose; between the two colors of the frons a velvet black line, wider at the sides. Occiput, cheeks, and palpi white pilose.

Thorax black in ground color, obscured by dense gray pollen on the dorsum, pleura, coxae, and scutellum; two vittae and the lateral margins paler; pile of mesonotum very sparse, reclinate, and white; pile of the pleura and coxae white. Halteres as in the male.

Abdomen black, but only the eighth segment shining, other segments with a dense covering of gray and brown pollen; base of third and fourth segments semishining brown and spots on the anterior corners of fifth and sixth segments. Pile on the basal segments black, a few erect black hairs on the dorsum of the third and fourth, most of the fifth segment black pilose, and all of the sixth, seventh, and eighth. Legs colored as in the male, with reclinate silvery white pile on the femora and a few erect white hairs. Wing membrane white or whitish hyaline; cell M–3 closed in the margin of the wing.

Type locality.—Pacific Grove, California, on the upper beach, May 8, 1906 (Dr. J. M. Aldrich).

Types.—Male, Cat. No. 25938, U.S.N.M.; allotype, female, in same.

There is a male paratype, taken at the same time with the types, in the National Museum collection. The species is easily distinguished in the male by the densely black pilose head and thorax, contrasting with the silvery white abdomen. The wings are noticeably whitish, especially in the female. It is undoubtedly a sand-dune species of local distribution, like the following new species.

THEREVA VANDUZEEI, new species.

Plate 10, fig. 123; plate 11, fig. 135; and plate 12, fig. 157.

Male.—Length 9 mm. Head black in ground color, the upper corner of frontal triangle velvety black, the lower part of frons and the face silvery white pollinose and yellowish pilose, the pile not very long or dense. Cheeks and occiput white pollinose, the upper occiput yellowish pilose, the lower occiput and cheeks white pilose, a few black hairs at the lower corner of the eye. Antennae black, the first two joints gray pollinose and with black bristles, third joint slightly shorter than the first and distinctly narrower (fig. 135), the arista short. The ocellar tubercle is dull brownish black; bristles of the occiput black.

Thorax black in ground color; dorsum light-gray pollinose, with three broad brown vittae, the central stripe narrowing and almost disappearing before the scutellum, the lateral stripes not reaching the front or rear of the dorsum; bristles of the thorax and the four bristles of the scutellum black. Mesonotum with golden-yellow reclinate pile, more erect in the anterior portion, the central part interspersed with erect black pile. Scutellum gray pollinose and rather long erect yellow pilose. Pleura gray pollinose, with yellowish pile before the halteres and wings, the rest of the pile white. Halteres black, the knob somewhat grayish pollinose and showing a trace of yellow color at the tip.

Abdomen black, densely gray pollinose and white pilose, the pile dense, reclinate, and silvery on the dorsum. Genitalia black, gray pollinose, largely white pilose, with some yellow hairs above and a few black hairs on the projections of the hypandrium. The epiproct much larger than the lower plates of the genitalia. Femora black, gray pollinose and white pilose; front femora with one black bristle below near the middle, middle femora with two, the hind ones with five or six; tibiae yellowish with blackened tips; base of the first tarsal joint yellowish, the other joints black. Wings whitish hyaline with a black stigma, costa to wing tip and R-1 yellow, the other veins black; cross veins and fork of Rs clouded blackish gray; cell M-3 narrowly open, first A closed in the margin; M-1 and M-2 very close together at the base or actually touching, there being a good deal of individual variation in this character. (Fig. 157.)

Female.—Length 10 mm. Very nearly like the male. The frons pale brown pollinose above, silvery white on the lower part, on each side near the middle a triangular velvet black spot, almost meeting in the center of the frons to form a band. Pile of head colored as in the male. Upper frons with a few black hairs mixed with the yellow. Bristles of antennae much shorter than in the male. Pile of the abdomen short, white, and reclinate on the first four segments, on the remainder short, erect, and yellowish. Base of first, second, third, and fourth segments broadly blackish gray and destitute of pollen, a very narrow border on the fifth; a narrow brownish posterior margin on the fifth, sixth, and seventh segments, the eighth wholly brownish.

Type locality.—Golden Gate Park, San Francisco, California, June 6, 1921 (E. P. Van Duzee).

Type.—Male and allotype female, in California Academy of Sciences; there are several paratype males and females taken at the same place on June 15, 1921 (Cole); a pair of these are deposited in the U. S. National Museum, No. 25939. There are two males in the collection of the California Academy of Sciences, one taken with the types and one July 10, 1920 (E. P. Van Duzee).

The species is named for E. P. Van Duzee, who made the trip to Golden Gate Park with the writer and collected the first specimen.

The species is probably local, being confined to the great sand-dune country around the edge of Golden Gate Park. Some of the specimens were taken on the wind-swept areas some distance from any vegetation. In no other species examined has there been found such a variation in vein M–1 and M–2, cell M–2 being petiolate in some specimens and broadly open in others. In one female the cell first A is narrowly open and there is an adventitious cross vein in the cell first M–2.

THEREVA NIVEIPENNIS Kröber.

Plate 11, fig. 134, and plate 12, fig. 160.

1914. *Thereva niveipennis* KRÖBER, Beiheft z. Jahrb. Hamb. Wiss. Anstalten, vol. 31, p. 66.

Male.—Length 9 mm. A species closely allied to *vanduzeei*. Head grayish white pollinose and largely white pilose, a few black hairs on the upper corner of the frons, and the pile of the ocellar tubercle black. Post-ocular bristles yellow, but there are two black bristles near the middle and some distance from the eye margin; the pile of this upper portion of the occiput yellow. Antennae black, the first two joints gray pollinose, with whitish pile and bristles; third joint almost as long as the first two combined, the arista short. (Fig. 134.)

The larger part of the mesonotum brownish pollinose, with two wide whitish vittae; the median brown stripe inclosed by these has a darker central portion, widened in the middle; mesonotum with erect white and reclinate yellowish pile, the reclinate pile on the lateral margins, however, and before the scutellum silvery white. Scutellum gray pollinose with a dark-brown basal spot and erect dark-yellow pile; there are four marginal bristles. Pleura gray pollinose and white pilose. Stem of the halteres yellow, the knob blackish brown.

Abdomen gray pollinose with a yellowish tinge to the pollen; second and third segments with a white posterior margin. Pile of the abdomen almost wholly white, reclinate on the dorsum, yellowish on the basal portion of the second to the fifth. The base of the second to the fifth segments narrowly blackish brown, with a dark median triangle projecting from it on which the pile is black and short. The external genitalia are without distinctive structure, blackish brown in color, with whitish pile; the hypandrium small and with scarcely any projections. Most of the tibiae and base of the first and second tarsal joints yellowish: femora, tips of tibiae, and most of tarsi blackish. Legs white pilose, the minute pile or setulae on the tibiae and tarsi white. Most of the bristles of the legs black, but there are a few yellowish bristles on the tibiae. Wings whitish, the veins on the basal portion yellowish, beyond blackish brown; cell M-3 closed and petiolate; stigma brown; the wings with several blackish gray spots in addition to those on the cross veins and the spot on the fork of R-4 and R-5. (Fig. 160.)

Type locality.—Alameda, California.

Type.—In the United States National Museum, Cat. No. 25946.

Although closely allied to *vanduzeei* the antennae are of somewhat different structure, and there are other characters which make it a very distinct species. The entirely white setulae of the legs is an unusual character.

This species was first described as new by the writer, the change being made in galley proof after seeing Kröber's 1914 paper.

THEREVA JOHNSONI Coquillett.

Plate 10, fig. 119, and plate 11, fig. 142.

1893. *Thereva johnsoni* COQUILLETT, Can. Ent., vol. 25, p. 200.

Coquillett's description of the female will serve to identify it.

Type locality.—Washington (O. B. Johnson).

The type was probably returned to Professor Johnson, as it is not in the National Museum and was not recorded in the type book when other species in the same article were. This specimen may be in the University of Washington now.

The male is very nearly like the female and is described below:

Male.—Length 11 mm. Pile of the body considerably longer than in the female. Pile on upper frontal triangle long, black, on the lower frons and face dense, yellowish, very long on the face. Black pile of frons reaches almost to checks on the sides. Pollen golden yellow on the frontal triangle, yellowish on the face, golden above on the occiput, yellowish gray below. Post-ocular bristles black and slender.

Thorax and scutellum black in ground color, yellowish pollinose, the mesonotum with two faint paler vittae. Pile of mesonotum and scutellum long, erect, mixed black and yellow, the majority yellow. Pleura thinly gray pollinose, dense yellow pilose. Knob of halteres brown, the stem yellowish.

Abdomen black in ground color, entirely yellowish pollinose on the dorsum and venter; largely long, erect, yellow pilose, with a few long black hairs above on the last segment and the yellowish red genitalia; most of the pile of genitalia yellow, on the upper forceps shorter and largely black. Front and middle femora with rather long pile, mixed yellow and black. Wings as in the female, the base of the wing and the costa yellow.

Neallotype.—A male, collected at Northbend, King County, Washington, July 9, 1920 (E. P. Van Duzee), [Cal. Acad. Sci.].

Specimens examined.—Two males, ten females.

Distribution.—Distribution according to 2 males and 10 females examined is:

Washington: Northbend, King County, July 10 (E. P. Van Duzee); Forks, Clallam County, July 2 (E. P. Van Duzee), [both Cal. Acad. Sci.]; Ilwaco, July 7 (A. Spuler), [Cole]; Longmire, Rainier Park, July 27 (E. C. Van Dyke), [Cal. Acad. Sci.].

Oregon: "Ore." (Hy. Edwards), [Amer. Mus.]; Hood River, June 28 to July 5 (Cole), [Cole]; Forest Grove, June 7 (L. P. Rockwood), [R. C. Shannon].

California: Carrville, Trinity County, July 1 (Van Dyke), [Cornell]; Fallen Leaf Lake, June 21 (A. K. Fisher), [Biol. Surv.]; Sisson, July 26 (E. P. Van Duzee), [Cal. Acad. Sci.].

THEREVA BRUNNEA, new species.

Plate 10, fig. 120; plate 11, fig. 152; and plate 12, fig. 164.

Male.—Length 9.5 mm. Head black, the upper frons and upper occiput yellow-ochraceous pollinose; face, cheeks, and lower occiput gray pollinose; face, cheeks, and occiput very densely dark-yellow pilose, some black pile on lower corner of eye and some on upper part of frons, running part way down on the face; pile of vertex and the post-ocular bristles black. First joint of antennae distinctly longer than the third, the first two joints yellowish gray pollinose.

Thorax black, mesonotum dark-brown pollinose, with a median black line; the form of the thoracic vittae much as in *frontalis* Say—two brownish yellow stripes on each side of a median stripe. Mesonotum rather densely golden-yellow reclinate pilose, with some erect black pile. Scutellum black, the margin yellowish pollinose, yellow pilose, with a few black hairs and four black bristles. Pleura gray pollinose and yellow pilose. Knob of halteres blackish, the stem yellow.

Abdomen black, shining except on the gray pollinose first segment; posterior margins of second to sixth segments golden-yellow pollinose, expanding on the sides of second and third; first to fourth segments yellow pilose, the pile long and erect at sides, reclinate above; the sides of fifth segment yellow pilose, the dorsum and all of the following segments long, erect black pilose. External genitalia blackish, black pilose, the internal organs reddish and golden-yellow pilose. Femora black, yellow pilose, with some long black pile on the outside of the front pair; tibiae, most of the first tarsal and base of other tarsal joints except last, yellowish; the tip of the tibiae blackish. Wings gray hyaline, with a small cloud at outside of cell first M-2 and a spot at furcation of Rs dark gray, the stigma blackish.

Female.—Length 10 mm. Very nearly like the male. Pile in general shorter, as is usual. Frons with a shining black callus reaching to the ocellus above but not to the eyes on the sides; dull black on the sides of the callus. (Fig. 120.) Abdominal segments one to three yellow pilose, the following segments short erect black pilose; segments two to seven with golden yellow posterior margins. Wings infuscated, especially along the veins and costal border.

Type locality.—Type, a male, and allotype, a female, the former collected at Victoria, British Columbia, July 3, 1919 (W. Downs), the latter at the same place, June 30, 1918 (W. B. Anderson).

Types.—In the Canadian National Museum.

The male type is teneral and is a bred specimen; the eyes are narrowly separated, but no doubt normal males would be holoptic.

Paratypes.—The following localities for 4 males and 13 females:

Canada: The type specimens above mentioned; Savary Island, British Columbia, August 11 (R. S. Sherman); Vancouver, British Columbia, August 9 (R. S. Sherman), [both Sherman coll.]; Vancouver, British Columbia, August 15 (R. C. Treherne); Chase, British Columbia, May 25 (W. B. Anderson), [both Canad. coll.]; Victoria, British Columbia, August 8 (R. C. Treherne), [Cole].

Washington: Forks, Clallam County, July 3 and 4 (E. P. Van Duzee), [Cal. Acad. Sci.].

Paratype.—Female, No. 25940, U.S.N.M.

THEREVA EGRESSA Coquillett.

1894. *Thereva egressa* COQUILLETT, Journ. N. Y. Ent. Soc., vol. 2, p. 99.

This species is related to *johnsoni* and is rather hard to determine from the description. No specimens were available for examination.

Type locality.—Colorado and California.

Type.—Male, No. 994, U.S.N.M., from Colorado.

THEREVA USTULATA Kröber.

1912. *Thereva ustulata* KRÖBER, Stett. Ent. Zeit., p. 265.

This species is said to be nearly related to *egressa* Coquillett. No specimens have been seen by the writer.

Type locality.—Laval County, Quebec, Canada.

Type.—Male, No. 24194, U.S.N.M.

THEREVA NIGRIPILOSA, new species.

Male.—Length 10.5 mm. A dull-black species, almost entirely black pilose. Head black, occiput gray pollinose, the face and frons thickly whitish pollinose; frons, occiput, cheeks, and outer rim of face long black pilose, most of the face whitish pilose.

Thorax black, gray pollinose, brownish on the mesonotum, with two faint vittae and the scutellum brown; pile of mesonotum long, erect, and black, the bristles black; pleura thickly black and white pilose. Halteres black, the stem a little paler.

Abdomen black, first segment thinly gray pollinose, the others black and shining or semishining; posterior margins of segments two to six narrowly yellow pollinose. Genitalia in part reddish, black pilose. Pile of venter on first three segments whitish, all the rest of the abdominal pile long, black. Femora black, black pilose, and bristled; tibiae reddish, the tips blackish; first tarsal joints largely yellowish as well as base of second joint of hind tarsi, the other joints black. Wings grayish hyaline, with a black stigma, the costal region and a spot just beyond the cell first M-2 smoky; cell M-3 closed in margin, R-4 gently curved.

Type locality.—Holotype, a male, bred from larva at Victoria, British Columbia, June 15, 1919 (W. Downs), [Canad. coll.].

Type.—In the National Canadian collection.

Paratypes.—Two paratypes were examined, both collected at Cranbrook, British Columbia, 3,500 feet, June 2 (C. Garrett). One specimen is deposited in the National Museum (No. 25942), the other is in the collection of Mr. C. H. Curran.

This species is in the group with *comata*, *nebulosa*, and *aurofasciata;* it differs from *nebulosa* and *comata* in the less spotted wings, the large extent of the black pile, etc.

THEREVA COMATA Loew.

Plate 10, fig. 131; plate 11, fig. 151; and plate 12, fig. 161.

1869. *Thereva comata* LOEW, Berlin. Ent. Zeit., vol. 13, p. 7.

Type locality.—California.

Type.—In the Museum of Comparative Zoology at Cambridge.

Without examining the type it is impossible to identify this species with certainty. Grouped around the species we have a complex which is difficult to work out without extensive collecting; we see such a group around *Villa* (*Anthrax*) *alpha* in the Bombyliidae, and we have the old problem of distinguishing between species, subspecies, and races or varieties.

In the forms related to *Thereva comata* the external male genitalia are apparently identical and the differences are more of coloration than structure. In some specimens there are six to eight strong bristles on the outside of the hind femora and in others there are fewer or none. The tips of the femora are reddish in some, and three specimens, possibly distinct species, from the Sierra Nevada Mountains in California (Hy. Edwards), [Amer. Mus.], have the femora and the pile of the body largely yellow; there is a narrow black band across the frons of the female and the hind femora lack the bristles on the outside. Specimens from Pismo and San Miguel Island, California, possibly form a distinct subspecies or race; they have more black pile on the body than the others, entirely black femora, the tergum of the abdomen largely dull black, without pollen, and the venter gray pollinose.

Kröber describes *comata* as having pollinose bands on the abdomen in addition to the yellowish incisures. I have examined a series of 18 specimens of what I take to be the typical form and in these the venter is gray pollinose. The male genitalia are small, the hypandrium much reduced and with yellow pile. The fourth to seventh tergites of the male abdomen have more or less brownish yellow pollen on the posterior borders; in the female the fourth and fifth abdominal tergites have gray pollinose borders. The female frons is golden yellow pollinose, black pilose, except above the antennae, and with a narrow shining black band interrupted in the middle by the yellowish pollen.

Specimens examined.—22 males, 5 females.

Washington: Wawawai, July 8 (R. C. Shannon), [Shannon].

California: Stanford University, May 17 to 25 [Stanford U.]; San Francisco (H. Edwards); "Cal." (Osten Sacken), [M. C. Z.]; "Cal." (E. T. Cresson), [A. N. S. P.]; Compton, April 15 (Cole); Stanford University, May 15 (Cole), [Cole]; Pismo, April 14 to 25 (E. P. Van Duzee); San Miguel Island, April 14 to May 20; Salada Beach, San Mateo County, May 25 (E. P. Van Duzee); Santa Cruz, June 3 (E. P. Van Duzee); sand dunes near San Francisco, May 31 (C. L. Fox); San Francisco, April 11 (C. L. Fox), [all Cal. Acad. Sci.]; Pasadena, [U.S.N.M.].

THEREVA NEBULOSA Kröber.

1912. *Thereva nebulosa* KRÖBER, Stett. Ent. Zeit., p. 264.

Type locality.—California.

Type.—In the collection of Kröber.

From the description this species is very close to *comata*. I have seen eight males of a form that would answer the description of this species. The abdomen is shining black above and below, the posterior margins of segments two to five bright golden yellow and quite broad. The legs are strongly bristled, especially the hind femora and tibiae, there being eight or nine strong bristles on the outside of the hind femora. The following distribution is known:

Washington: W. Wash. Terr. (H. K. Morrison), [U.S.N.M.].

California: Pacific Grove, May 8 (J. M. Aldrich), [Aldrich]; Carmel, Monterey County, May 2 (L. S. Slevin); Santa Cruz, June 3 (E. P. Van Duzee), [both Cal. Acad. Sci.].

THEREVA FOXI, new species.

Male.—Length 8.5 mm. A species related to *comata* Loew and very near *nigripilosa* described above. It differs from the latter species in having more bristles on the first antennal joint, the face more blackish pilose. The vittae on the mesonotum yellowish brown and very distinct. Stem of halteres blackish. Pleura with more black pile than *nigripilosa* or *comata*, the abdomen shining black much as in *nebulosa*. The projections of the hypandrium are very short. Wings with distinct brown clouding along the veins and cross veins, all the veins black or blackish brown.

Type locality.—Holotype, a male, collected at Paradise Valley, on Mount Rainier, Washington, August 7, 1919 (C. L. Fox).

Type.—In the California Academy of Sciences.

There is a male paratype in the collection of the California Academy of Sciences taken in the type locality July 30 by Mr. Fox. The wings do not have the brownish tinge common to *comata* and lack the distinctly mottled appearance.

THEREVA AUROFASCIATA Kröber.

1912. *Thereva aurofasciata* Kröber, Stott. Ent. Zeit., p. 263.

The following is a translation of the original description:

Male.—Vertex gray-brown pollinose, frons and face more grayish. The long, thick, black pile of frons reaches almost to lower corner of eye. Face long white pilose, on eye angle a black tuft. Antennae black, black bristled, base of third joint reddish. Occiput gray, below long and woolly whitish yellow pilose. Orbital bristles black. Thorax blackish brown, yellowish brown pollinose, long and thick erect blackish brown pilose. Scutellum like the thorax. Stripes lacking on both. Pleura whitish pilose. Halteres blackish brown, stem paler. Abdomen shining blackish brown, unusually thick and long pilose. Second to sixth segment with sharply marked yellowish gray pollinose bands, which on each segment become broader. Second to fourth segments with orange-yellow borders. Pile of abdomen above blackish brown, on the sides and venter long, erect, rather thick whitish pilose, on the apex reddish yellow. Anal lamellae reddish yellow. Venter black, through pollen dull yellowish gray. Second to fifth segments with broad yellow bands which, however, on account of pale pollen do not appear so heavy. Wings tinged brownish; cross veins and fork brownish bordered. Stigma rather dark brown. Femora blackish brown; the four first ones long erect pilose, blackish brown or light according to the illumination. Hind femora sparsely short reclinate pilose. Tibiae and tarsi yellowish brown, the tips darkened. Length 13 mm.

Type locality.—Southern Colorado.

Type.—In the Hofmuseum, Vienna.

The National Museum contains a male specimen, determined by Kröber, from Wisconsin.

THEREVA FRONTALIS Say.

Plate 10, fig. 121, and plate 11, fig. 150.

1824. *Thereva frontalis* SAY, Long's Exped. to St. Peters River, vol. 2, p. 370.

Type locality.—"N. W. Territory."

Type.—Not in existence.

The species is redescribed below:

Male.—Length 10 to 11 mm. Head black, gray pollinose, the upper corner of frontal triangle black; frons black pilose. Face and occiput white pollinose, the outer margin of face and a spot beneath the eye black pilose, the rest of face and occiput white pilose. Palpi brown, white pilose. Bristles of occiput black. The antennae black, first joint about the length of third ,gray pollinose, with black pile and bristles.

Thorax black, gray pollinose; mesonotum with a median blackish brown stripe and two indefinite whitish vittae, on the outer side of which is some brown pollen. Scutellum gray pollinose with very fine blackish pile and four black bristles. Pile of mesonotum erect and blackish. Pleura gray pollinose, white pilose, with a few black hairs in the cluster of pile before the base of wing. Stem of halteres yellowish, the knob black, largely gray pollinose.

Abdomen black, largely gray pollinose, the hind margins of second, third, and fourth segments narrowly whitish; base of first to sixth segments with a large, semicircular blackish brown spot, rounded posteriorly and almost reaching the posterior margin. Genitalia blackish on the exterior, the hypandrium with very short projections (fig. 150) and yellow pilose, the upper portion with black pile on the outside. Sixth and seventh segments black pilose; the first to fifth black pilose on the dorsum, white on the sides, long, erect, and rather sparse. Venter gray pollinose, the posterior borders of segments two to five yellowish white; pile of the first four segments white, beyond this black. Femora black, the short reclinate pile of the hind pair black, a few erect white hairs at the base; pile on the four front femora largely long, erect, black, a few white hairs above; knees yellow; tibiae yellow with black tips; most of the tarsi black, the first joint and sometimes the base of the second yellowish.

Wings hyaline, the veins light brown, stigma brown, the cross veins and fork of Rs clouded brown; cell M-3 closed near the margin.

Female.—Length 11.5 to 13 mm. Very nearly like the male. Pile of head and mesonotum much shorter. Frons yellowish gray pollinose and black pilose, with a large, reverse heart-shaped, shining black callosity, reaching the ocellar tubercle above and joined to the eyes on the sides by a dull black mark. (Fig. 121.) Upper occiput yellowish gray pollinose; face and lower occiput white pollinose and pilose. Some black pile at the lower corner of the eye.

Mesonotum gray pollinose on the lateral margins, the main portion dark brown, with two wide yellowish white vittae, so that an appearance is given of three wide dark-brown vittae. Base of scutellum brown, the larger part gray pollinose. Mesonotum with short reclinate yellow pile in addition to the erect black pile, the reclinate pile continued on to the scutellum.

Abdomen shining black; first segment gray pollinose, segments two to six with narrow yellowish posterior borders and a gray pollinose area anterior to this, narrow in the middle of the dorsum and expanded on the sides. The black portions of the first three segments reclinate blackish pilose, the rest yellowish white; all pile beyond the third segment short, erect, black. Genitalia shining black, the circlet of bristles yellowish red. Legs colored as in the male, the pile of femora much shorter and whitish. Veins of wing largely with a narrow border of pale brown, more distinct on the cross veins.

Distribution.—Distribution according to 4 males and 24 female specimens:

Two female specimens taken in the Hope Mountains, British Columbia, July 19 (R. S. Sherman) and one specimen from Paradise Valley, Mount Rainier, Washington, July 17 (E. C. Van Dyke), may prove to be different; in these specimens the frontal callosity is divided in the middle by an impressed line, on either side of which it projects into a hemispherical body. It is in general a darker form, with the markings of the wings darker.

Canada: Ile de Montreal, July 14 (Beaulieu); Ottawa, Ontario July 9 (Beaulne); Rigaud, Quebec, June 27 (Beaulieu); Lillooet, British Columbia, May 26 and September 6 (W. B. Anderson), [all Canad. coll.]; "Canada" (Osten Sacken), [M. C. Z.]; Hope Mountains, British Columbia, July 19 (R. S. Sherman); Similikameen, British Columbia, July 20 (R. S. Sherman), [Sherman]; Montreal, Quebec, June 17 [Amer. Mus.]; Kearney, Ontario, July 2 to 8 (M. C. Van Duzee), [Van Duzee]; Jordan, Ontario, June 29 (C. H. Curran), [Cole].

New Hampshire: Mount Washington, August 7 (C. W. Johnson), [Cole].

Massachusetts: "Mass." (Osten Sacken), [M. C. Z.]; Rutland, June 5 (C. W. Johnson); Brookline, June 17 (C. W. Johnson); Waltham, June 14 (C. W. Johnson), [Cole].

New York: North Elba, July [Amer. Mus.]; Ithaca, July 2; Slaterville, June 14 [both Cornell]; Gowanda, June 14; Lancaster, June 30 [both M. C. Van Duzee].

Illinois: "Illinois" (Osten Sacken), [M. C. Z.].

Michigan: Agricultural College, June 5 to July 12 [Cornell]; Pequaming, July 11 and 28 (M. Hebard), [Harrisb. coll.].

Colorado: Spanish Peaks, June 15 (Osten Sacken), [M. C. Z.].

Idaho: Moscow Mount, June 23 (Cole), [Cole].

Washington: Paradise Valley, Mount Rainier, July 17 (E. C. Van Dyke), [Cal. Acad. Sci.].

THEREVA FLAVICINCTA Loew.

1869. *Thereva flavicincta* (male) and *gilvipes* (female) LOEW, Berl. Ent. Zeitschr., vol. 13, p. 168.

Type localities.—The type males were described from northern Wisconsin and White Mountains, New Hampshire, the female (as *gilvipes*) from Massachusetts.

Types.—In the Museum of Comparative Zoology at Cambridge.

The one male examined was 10 mm. in length, the genitalia rather small, yellowish brown, with yellowish white pile. The female is 10.5 to 12 mm. in length; the frontal callus heart-shaped, deeply notched below, with a dull black mark joining to the eyes on each side as in *frontalis*. The species has been reported from New Jersey.

Distribution.—The following distribution is known for the species:

Canada: Ridgway, Ontario, June to July 20; Fort Erie, July 5; Kearney, July 8 (all M. C. Van Duzee), [Van Duzee].

New Hampshire: White Mountains (Geo. Dimmock), [Cole]; White Mountains (Osten Sacken), [M. C. Z.]; Bretton Woods, June 30 (M. C. Van Duzee), [Van Duzee].

New York: Little Valley, June 30; Protection, June 16 (both M. C. Van Duzee), [Van Duzee].

THEREVA FLAVICAUDA Coquillett.

1904. *Thereva flavicauda* COQUILLETT, Invertebr. Pacifica, vol. 1, p. 23.

Type.—Female, No. 6710, U.S.N.M.

The only specimens known to the writer are the type and paratype females in the National Museum, taken in Ormsby County, Nevada.

THEREVA DUPLICIS Coquillett.

Plate 10, fig. 122; plate 11, fig. 148; and plate 12, fig. 159.

1893. *Thereva duplicis* COQUILLETT, Can. Ent., vol. 25, p. 198.

Type localities.—Coquillett's material was from South Dakota and Montana. The types are in the National Museum collection.

Type.—Male, No. 10422, U.S.N.M., from Brookings, South Dakota; an allotype female from same place, and a paratype from Montana.

Distribution.—The distribution according to eight males and two females examined is: Canada: Regina, July 25 (T. N. Willing); Regina, July 8 (J. Fletcher); Duadum, July 15 (A. E. Cameron); Saskatoon, July 11 (A. E. Cameron); Prince Albert, July 16 (J. Fletcher), (all in the Province of Saskatchewan); Aweme, Manitoba, July 1 to August 4 (N. Criddle), [all specimens in Canad. Nat. collection.].

THEREVA DIVERSA Coquillett.

1894. *Thereva diversa* Coquillett, Journ. N. Y. Ent. Soc., vol. 2, p. 100.

This species was not found in any of the material sent in for examination. Kröber states that the halteres are reddish yellow. The type material is probably not all one species.

Type localities.—Colorado, Montana, and Florida.

Type.—Male, No. 995, U.S.N.M., from Colorado; allotype, female, from same; four cotype males from Colorado (2), Montana, and Florida.

THEREVA CINGULATA Kröber.

Plate 11, fig. 155.

1912. *Thereva cingulata* Kröber, Stett. Ent. Zeit., p. 267.

The original description is as follows:

Female.—Frons and vertex yellowish brown pollinose, sparsely weak blackish brown pilose. Face white pollinose and pilose. Antennae blackish brown; yellowish gray pollinose, black bristled. Second joint and base of third reddish. The callus is a triangle, whose tip reaches the front ocellus and in which a pubescent wedge is pushed in at the base. Inasmuch as the tip of the callus is buried under pollen, one might say that it is composed of two triangular spots. Occiput above yellowish brown; below white pollinose and pilose. Post-ocular bristles black. Thorax thickly yellowish brown pollinose, opaque, with dull brownish vittae, the middle one divided by a red brown, strongly colored line, which reaches to the scutellum. Pile reclinate yellow, erect blackish brown. Pleura light gray, snow-white woolly pilose. Halteres brownish, the stem paler. Abdomen shining black. First segment yellowish gray pollinose, golden yellow pilose. Second to sixth segments with yellow pollinose bands, which on the anterior segments are considerably expanded laterally. The last segment principally reddish yellow, shining. Pile on all light parts pale yellow, on the dark parts blackish brown. Venter at the base whitish gray, then light yellow, then brownish yellow. Pile on the first segments long and white, on the last short, almost golden yellow. Femora blackish brown, tips darkened. Wings hyaline; the cross veins and fork clouded pale brownish. Fourth posterior cell closed. Length 10 mm.

Type locality.—Colorado.

Type.—In the Hofmuseum, Vienna.

The writer has seen several specimens which seem to answer the description of this species; one of the males is designated as a neallotype and is described below:

Male.—Length 9 mm. In general darker in color than the female. The pollen of the frons gray with a yellowish tinge. Pile of the face largely whitish, that on the outer margin erect, black, and reaching to the cheeks. Pile of frons black and considerably longer than in the male.

Thorax darker than in the female, less distinctly marked, the mesonotum in general more slate colored. Pile of mesonotum and scutellum largely black, erect, and rather long, with some shorter yellow pile. Pile of pleura largely yellowish white.

First segment gray pollinose; posterior margins of segments two to six yellowish, with yellowish gray pollen which widens out laterally. Venter colored much like the dorsum of abdomen, the yellow color and yellowish pollen more extended. Pile of dorsum sparse, black, rather long; pile on the venter yellowish. Genitalia yellowish red, the upper portion darker, the hypandrium with a long apical projection on each half (fig. 155), much longer than in any other species examined.

Neallotype.—A male, collected in the mountains near Sheridan, Wyoming (Wm. Metz), [U.S.N.M.].

The neallotype is from the collection of J. M. Aldrich. It is an imperfect specimen, but the only other male examined is in worse condition; the third joint is missing from both antennae and one of each pair of legs is gone, otherwise the specimen is well preserved.

Distribution.—The distribution according to two males and four females is:

Montana: Gallatin Mountains, August 15, 6,000 feet [Mont. Exp. Sta.].

Wyoming: Sheridan, in mountains (Metz), [U.S.M.N. and Pomona College].

Colorado: Veta Pass, June 27 [U.S.N.M.].

THEREVA NEOMEXICANA, new species.

Female.—Length 10.5 mm. Allied to *frontalis* Say and *cingulata* Kröber, perhaps nearer to *cingulata* than to any other described species, differing from this species in having the pile of the face and occiput distinctly yellow instead of white. Antennae black, gray pollinose, with short black bristles and yellowish pile; third joint about as long as first and scarcely wider. The shining frontal callosity reaching to the ocelli and with a deep wedge of golden-yellow pollen below.

Thorax black, pale brownish gray pollinose, with two whitish vittae and a very narrow dark-brown median stripe which widens posteriorly and crosses on to the scutellum; pile of the mesonotum mixed black and yellow. Scutellum gray pollinose and yellow pilose.

Pile of pleura and pectus yellowish. Stem of halteres yellowish, the knob brown.

Abdomen black, with posterior margins of second, third, and fourth segments very narrowly yellow above and more broadly on the venter, which is entirely gray pollinose. Sides and posterior borders of segments gray pollinose; first tergite with a small central portion colored brown; second, third, and fourth segments largely semishining blackish brown, also the basal half of the fifth and sixth; seventh segment shining black; genitalia black with a reddish tinge, the terminal circlet of spines reddish; a few black hairs on the genital segment, all the rest of the abdominal pile yellowish. Femora black, gray pollinose, sparsely yellowish pilose; bristles of legs black; tibiae except tips and base of tarsi yellowish, the rest of the legs black. Base of the wing yellowish, the costal margin, tip, and posterior margin infuscated; brown clouds on the cross veins, and a brownish gray margin to most of the veins, the centers of the cells whitish; cell M-3 closed near margin; veins blackish brown toward the posterior margin of the wing.

Type locality.—Rio Grande River, New Mexico (Oslar), [from the collection of W. G. Dietz].

Type.—Female, No. 25943, U.S.N.M.

Paratypes.—There is a paratype in the same collection from the arroyo Pecos River, New Mexico.

A male in the same lot of material may prove to be this species; the specimen was taken at Chimney Gulch, Colorado, near Golden. The wings are the same as in the above species and there are several other characters in common, but, as it is not a good specimen, it is better not described. The eyes are separated by the width of the ocellar tubercle, but perhaps this is an individual abnormality.

THEREVA STRIGIPES Loew.

1869. *Thereva strigipes* LOEW, Berlin. Ent. Zeitschr., vol. 13, p. 169.

Loew described only the female of this species.

Type locality.—Lake Winnipeg, Canada.

Type.—In the Museum of Comparative Zoology at Cambridge.

Distribution.—Kröber redescribed the species in his paper on the Therevidae of North America, giving the region around Lake Winnipeg and Colorado as the habitat. The species has been recorded from Axton, New York (O. A. Johannsen), and White Mountains, New Hampshire (Mrs. Slosson). One female in the National Museum collection, taken at Center Harbor, New Hampshire (H. G. Dyar), may belong here. C. W. Johnson kindly loaned a male and female for study, from which the following notes are made:

Male.—Length 10 mm. The specimen is evidently teneral and the thorax slightly greased. Frons and face grayish white pollinose, the upper corner of frontal triangle dull brown. Pile of frons and outer margin of face long and black, on most of the face dense and white; some black pile on the cheeks below the eye. Antennae as described by Loew for the female.

Mesonotum gray pollinose with three indistinct brownish vittae, the median one divided by a darker brown line; pile of mesonotum rather long, dense, erect, and black. Pleura gray pollinose and dense white pilose, a few darker pile before the wing base. Coxae with dense white pile. Stem of halteres yellow, the knob brown.

Abdomen largely black in ground color, first segment gray pollinose, the tergites of other segments largely shining blackish brown; posterior margins of segments yellow, with a border of gray pollen widening laterally. The color of the venter is probably blackish brown in mature specimens with yellow posterior margins. Pile on sides of abdomen and on venter long and whitish, the dorsum largely black pilose; genitalia brownish with black pile above and white below. Four front femora blackish brown, the hind pair dark above, yellowish beneath; pile of femora largely white, intermixed with long black pile on the posterior side of the four front femora. Wings grayish hyaline; cell M–3 closed.

Female.—Length 13 mm. In the single specimen the upper two-thirds of frons is shining black and bare of pollen; in fresh specimens there may be a narrow pollinose line along the orbits; lower third of frons golden-yellow pollinose and black pilose. Face whitish pollinose, the white pollen reaching slightly above the base of the antennae; pile short and white, a few black pile on the outer margin above.

The mesonotum is dark-gray pollinose with a broad central blackish brown vitta reaching to scutellum and two broad stripes, one on either side, abbreviated before the humeri and scutellum and separated from the median stripe by a distinct yellowish pollinose line which broadens out anteriorly. Base of scutellum blackish brown, the broad margin gray pollinose, the pile yellow.

First abdominal segment gray pollinose, the rest of dorsum largely shining black; posterior margins of second to sixth segments bright golden yellow, just in front of which there is an area of yellowish gray pollen, widening laterally; third abdominal segment largely black pilose. Venter thinly gray pollinose, the pile and posterior margins as on the dorsum. Genitalia with a circlet of reddish spines. Middle pair of legs missing. Anterior femora blackish, brown at extreme base, the posterior femora blackish brown above and reddish below; pile of femora short and whitish. Costal cell of wing brown.

The male and female examined were from the following localities:

Vermont: Burlington, June 24 [B. S. N. H.].

New Hampshire: Glen House, July 3 [B. S. N. H.].

THEREVA HIRTICEPS Loew.

Plate 10, fig. 126, and plate 12, fig. 166.

1874. *Thereva hirticeps* Loew, Berl. Ent. Zeit., vol. 18, p. 382.

Male.—Length 9.5 to 12.5 mm. Ground color of body largely black. Frontal triangle yellowish pollinose, the upper margin narrowly black; a line of black pile on the frons next the eye margin, most of the frontal pile yellow. Face gray pollinose with dense whitish pile. Antennae black, the base of the third joint may be reddish; first joint about as long as the third, yellow pilose with black bristles; style short. Some black pile on the cheeks below the eye. Occiput largely gray pollinose, the upper part yellowish; pile below whitish, on the upper part golden yellow. A shining black line on the face from the base of the antennae to the oral margin.

Mesonotum shining black except for two yellowish vittae, widely separated, slightly divergent anteriorly and reaching as far as the prescutellar bristles posteriorly; in some specimens the lateral margins of the mesonotum are thinly grayish pollinose. Pile of the disk of mesonotum erect and blackish, around the lateral margins yellowish, dense over the wing base. Scutellum shining black, with long erect yellow pile, four marginal black bristles, and occasionally a few black pile. Pleura gray pollinose, largely whitish pilose, with a yellowish tinge to the pile before the halteres and wing base. Stem of the halteres yellow, the knob blackish brown.

Abdomen largely shining black, the posterior corners of segments one to six brownish yellow, the seventh segment and genitalia brownish yellow. Posterior margins of second to sixth segments bright yellow, with reclinate yellow pile on the second to fifth; sides of the first to fifth long erect yellow pilose; dorsum of the sixth, seventh, and genitalia black pilose. Posterior margins of second to sixth segments of venter bright yellow, the posterior halves of the same ventral segments brownish yellow, the basal part black. Pile of the venter yellow, including that below on the genitalia. Basal half of femora black, the apical portion, tibiae except apices, and base of tarsi reddish brown; tips of the tibiae and most of the tarsi black. Bristles of legs black. Pile of hind femora almost all tomentumlike and black, on the front femora mixed black and white, long, and erect on the outside and below, all black on the apical third. Veins at base of wing yellowish, black beyond; cell M-3 closed and short petiolate; stigma blackish brown; costal cell yellowish, the rest of the margin of the wing smoky gray, as are the clouds on the cross veins; central portion of the wings largely whitish hyaline.

Female.—Length 10.5 to 13 mm. Closely resembles the male, with the usual sexual differences. Frons and vertex yellowish pollinose, the shining black callosity reduced to a band touching the eye margin on either side (fig. 126); pile of the frons almost wholly black, except for a few yellow hairs above the antennae. First antennal joint with mixed black and yellow pile.

Pile of mesonotum shorter than in the male, with more yellow anteriorly and laterally; lateral margins and humeri distinctly gray pollinose, the thoracic vittae reaching the scutellum and merged with the pollen on the prescutellar callosities. The margin of the scutellum broadly yellowish white pollinose.

Abdomen marked nearly as in the male, the shining black portions of the dorsum with black pile, the pile of the lighter parts of the first four segments yellow, a few yellow pile on the sides of the fifth, the rest of the pile to the tip of the abdomen erect and black, both on the dorsum and venter; terminal circlet of spines black.

Reddish color of the venter more extended than on the dorsum. Femora, tibiae, and base of tarsi reddish brown, the trochanters and the larger part of the tarsi black; pile of the femora more sparse than in the male. Wings as in the male. (Fig. 166.)

Type locality.—San Francisco, California.

Type.—In the Museum of Comparative Zoology at Cambridge.

Loew described only the female of this species. A male neallotype is designated, the specimen collected on the sand dunes near Golden Gate Park, San Francisco, October 10, 1920, by E. P. Van Duzee, and is deposited in the collection of the California Academy of Sciences.

Distribution.—The distribution according to 12 males and 9 females examined is: California—San Francisco, August 18 (R. H. Smith); San Francisco, October 9 (J. A. Kusche); Colma, August 10 (J. A. Kusche); Ingleside, near San Francisco, October 14; sand dunes near Golden Gate Park, October 10 (E. P. Van Duzee), [all Cal. Acad. Sci.]; sand dunes near Golden Gate Park, October 10 (F. R. Cole), [Cole].

This species is more closely related to *fucata* than to any other described species, but is quite distinct in the marking of the frons, general coloration, etc. It is probably confined largely to the sand dune areas along the coast and is evidently an autumn species. A pair was taken in coitu on October 10 by the writer.

THEREVA PSEUDOCULATA, new species.

Plate 11, figs. 132 and 153.

Male.—Length 8 mm. Body black, densely gray or yellowish gray pollinose. First joint of antennae as long as the second and third combined (fig. 132), gray pollinose, with sparse pile and short black bristles; second joint and base of third usually yellowish. Bristles of occiput black and rather long and slender. Frontal triangle yellowish gray pollinose, with long black pile in the median portion; face gray pollinose, largely black pilose, the pile in the middle portion yellow. Palpi yellowish with yellow pile. Pile of the occiput and cheeks yellowish and not very dense.

Thorax yellowish gray pollinose, with two faint vittae of paler color; pile of mesonotum yellowish white, with a few black hairs intermixed. Scutellum, pleura, and coxae thickly gray pollinose, the pile whitish. Halteres yellowish, base of knob brown.

Abdomen black, with narrow yellow posterior margins to segments two, three, four and five; densely gray pollinose, with sparse, rather long erect yellow pile. Venter as above. Genitalia reddish yellow, with rather long yellow pile, a few black hairs above and on seventh segment. (Fig. 153 for structure.) Femora blackish, more or less yellowish toward apex, the pile largely yellowish white, some black at the apex; tibiae and tarsi yellowish, darkened apically. Wings yellowish and gray hyaline, the stigma pale brown, most of the veins yellow, but brown in certain sections, as the at tips of the veins, the fork of Rs and the cross veins; cell M-3 narrowly open.

Female.—Length 9.5 mm. Resembles the male. Pile of face shorter and all yellowish, as on the cheeks and occiput; a few black hairs on the frons. The frons has two shining black hemispherical calli near the middle; pollen of frons and vertex golden yellow, that on the face and lower occiput white.

Thorax with sparse erect black hairs and reclinate yellowish pile. Mesonotum largely pale brownish gray, the two vittae and lateral margins paler brownish gray. Base of the scutellum broadly brownish. Abdomen black in ground color, posterior margins of the third to the last segment yellowish gray and yellow pollinose; posterior margin of the second segment whitish; the yellow color of the fifth broad, the segments beyond the fifth and the genitalia reddish yellow. Pile of the abdomen yellow, reclinate on the first two segments, erect on others; seventh segment and genitalia shining, with more or less black pile on the dorsum. Femora largely yellowish, darker above, the pile much shorter than in the male. Wings more brownish in color, the veins darker.

Type localities.—Holotype, male, collected at Brigham, Utah, July 4, 1911 (J. M. Aldrich), and allotype, female, taken at Salt Lake City, Utah, July 18, 1917 (J. M. Aldrich). [U. S. National Museum].

Type.—Male, Cat. No. 25944, U.S.N.M.

The holotype was taken on parsnip flowers, three male paratypes being taken at the same time.

Paratypes.—The distribution according to five males and four females is:

Colorado: Gunnison (C. F. Baker), [Stanford Univ.].

Montana: Dillon, July 8, on alfalfa [Mont. Exp. Sta.].

Washington: Wapato, May 11 (Cole), [Cole]; Yakima River, Nelson's, July 4, 1882 [M. C. Z.].

Utah: Brigham, July 4 (J. M. Aldrich), [U.S.N.M.]; allotype above mentioned.

The specimen from Yakima River has the first antennal joint yellow and is 10 mm. long. The Montana specimen is 11.5 mm. in length, with yellow femora and first antennal joint; the last four abdominal segments almost entirely yellow. The male collected at Wapato, Washington, has paler wings, whitish hyaline in spots; first antennal joint yellowish; a few black hairs on the sides of the face, the other pile dense-golden yellow.

THEREVA FUCATA Loew.

Plate 11, fig. 154, and plate 12, fig. 162.

1872. *Thereva fucata* LOEW, Berlin. Ent. Zeit., vol. 16, p. 74.

This species has the first two antennal joints and base of third yellowish. The legs of the female are wholly yellow, largely so in the male. The thorax is shining black, with ochraceous pollinose vittae and lateral margins. The type, collected in California by Edwards, is in the Museum of Comparative Zoology at Cambridge, Massachusetts.

There are several closely related forms which might answer the description of this species; those seen by the writer are western in their distribution and are possibly all the same variable species or subspecies of the typical form. The wing of one type is shown in figure 162 and the male hypopygium in figure 154. Dissections of the male genitalia may reveal specific differences, but material is not available at present.

Loew describes the wings as having three unequal brown fascia, arcuate, and abbreviated anteriorly; only six specimens of this typical form were examined, one from Utah and five from California. Some specimens have less clouding in the wings than is shown in figure 162. A male from Little Bear Valley, California, has some differences in color and may prove to be a good species.

Distribution.—Distribution according to 6 males and 16 females is as follows:

Canada: Savary Island, British Columbia, August 23 (R. S. Sherman); Hope Mountains, British Columbia, July 27 (R. S. Sherman), [both R. S. Sherman]; Lillooet, British Columbia, September 8 (R. C. Treherne), [Cole].

Wyoming: Mountains near Sheridan (Wm. Metz), [Pomona College].

Colorado: Gunnison (C. F. Baker), [Stanford U.]; Leadville N. F., 25 miles from Buenavista, September 1 (A. K. Fisher), [Biol. Surv.].

Oregon: McDermitt, Malheur County, August 20 (J. R. Bunch), [Biol. Surv.].

Utah: Deer Creek, Provo County, August 27 (T. Spaulding), [C. W. Johnson].

California: Sugar Pine, Madera County, 4,300 feet, August 14 (J. C. Bradley), [Cornell]; Redwood Mdw., Tulare County, August 4 (J. C. Bradley), [Cornell]; Santa Clara County (Harkins); Stanford University, October 10; Santa Cruz Mountains [all Stanford U.]; Little Bear Valley, San Bernardino County, August [Cal. Acad. Sci.]; Mill Creek Canyon, San Bernardino County, 4,000 feet, August 7 (Cole), [Cole].

THEREVA BAKERI, new species.

Plate 12, fig. 163.

Male.—Length 7.5 to 8.5 mm. In general appearance somewhat similar to *fucata* Loew. Frons yellowish gray pollinose, with black pile above, yellow pile on the lower part. Face gray pollinose, the sides with black pile down to the cheeks, the central portion yellow pilose. Occiput gray pollinose, with black bristles and yellow pile. First two antennal joints and base of the third yellowish red, most of the third joint and the style brown. A few yellow pile on basal part of first antennal joint, the rest of the antennal pile rather long, dense, and black. First antennal joint slender, slightly longer than the third.

Thorax gray pollinose, with three sharply defined dark-brown pollinose vittae, the middle stripe blackish brown, those on the sides abbreviated anteriorly and posteriorly. Pile of mesonotum mixed black and yellowish. Scutellum grayish brown, with yellowish pile and four black marginal bristles. Pleura gray pollinose, whitish pilose. Halteres yellowish, the knobs partly brown.

Abdomen largely reddish yellow; dorsum of the first segment black, gray pollinose; second to fifth segments with basal black triangles, narrower on the fourth and fifth. Most of the abdominal pile yellowish, with black pile on the black triangles, upper part of the fifth and sixth segments, and the genitalia. Pile of the hypandrium long and yellow, dense on the projections. Basal portion of femora blackish, the black color more extended on the hind pair; pile of the femora mixed black and yellow. Bristles of the legs black. Costal cell and veins at base of wing yellowish, the other veins black; most of the wing marked with dark gray or smoky brown clouds, the intervals whitish (fig. 163); cell second M and first A largely hyaline; cell M-3 open in the margin.

Female.—Length 10 mm. Closely resembles the male. In the specimen described the third antennal joint is yellowish. Frons distinctly convex, the heart-shaped shining callosity reaching to the ocellar tubercle, a few black pile just below it and on the vertex, the rest of the pile of the frons and face yellow. Frons yellow pollinose, the face grayish white. Except for the black tuft below the eye, the pile of the cheeks and lower occiput white, that on the upper occiput yellow; bristles of the occiput black.

Pile of thorax shorter than in the male, the lateral vittae pale brown and more indistinct; pile of the lateral margins of the mesonotum golden yellow. First abdominal segment almost entirely yellow, all the other segments with black anterior margins, the pile on the black portions black, on the yellow portions of the first two segments yellow; the rest of the abdominal pile black and longer than usual. Most of the coxae and femora, tibiae except the apices, base of the first two tarsal joints yellowish, the last tarsal joints brown. The portions of the wing whitish in the male are grayish hyaline or with a yellowish tinge, the costal cell gray.

Type locality.—Mountains near Claremont and at Claremont, California (C. F. Baker).

Type.—Male, No. 25945, U.S.N.M.; allotype, female, same.

Specimens examined.—Three males, one female.

Paratypes.—There are two paratypes, one was collected at East Highlands, San Bernardino County, California, September 14 (F. R. Cole), [Cole]; the other specimen was taken in Santa Clara County, California (Harkins), [Stanford Univ.].

THEREVA FLAVIPILOSA, new species.

Plate 11, fig. 136.

Male.—Length 8.5 mm. Head black, the face, frons, and occiput whitish pollinose. Pile of vertex, top of frons, and outer margin of face black, the rest of the pile of the head deep yellow. Antennae small, black, the third joint about the length of the first, with the tip expanded (Fig. 136.) Pile of the head very dense.

Thorax, pleura, and scutellum black, thickly covered with erect yellow pile; mesonotum and scutellum shining; scutellum with a yellow pollinose border; two well-defined, widely separated yellow vittae on the mesonotum. Knobs of halteres brown, the stem yellow.

Abdomen black, some black pile on the dorsum of all the segments, including the genitalia, the larger part of the pile long and yellow; posterior margins of segments two to six yellow, yellowish pollinose, the color expanding and more shining on the sides. Upper lamellae of genitalia brown, the hypandrium brown at base, otherwise reddish yellow and long yellow pilose. Venter almost entirely yellow, the segments narrowly black at the base. Basal two-thirds of femora, tip of tibiae, and two basal joints of tarsi black, other parts of the legs yellowish; front femora with black and yellow pile below, the two hind pairs with only yellow pile, largely reclinate. Wings gray hyaline, R-4 distinctly curved, cell M-3 closed before the margin; a faint gray cloud on the anterior cross vein; stigma yellowish brown.

Type locality.—Huntington Lake, Fresno County, 7,000 feet, July 26, 1919 (E. P. Van Duzee).

Type.—Male, in the California Academy of Sciences.

THEREVA BOREALIS, new species.

Female.—Length 11 mm. Head black; upper half of frons brownish pollinose, the lower part and face silvery white; a few short black hairs on the upper part and above the antennae; pile of face very short, white; cheeks and occiput white pollinose and pilose, the bristles on latter black. Antennae short, black, the first joint about as long as the third, gray pollinose, with white pile basally and a few apical black bristles.

Thorax black, mesonotum gray pollinose, with two distinct whitish vittae on the blackish gray dorsum. Scutellum, pleura, and coxae black, gray pollinose, white pilose. Mesonotum with mixed short black and white pile. Halteres yellowish at base and tip, base of knob blackish, the knob gray pollinose.

Abdomen black, largely shining black; first segment gray pollinose, with narrow silvery gray posterior margins on the second and third segments; fifth and sixth silvery gray pollinose except the base. Venter gray pollinose. Pile of abdomen short and sparse, white and reclinate on the first three segments, black and erect on the others. Femora black, very short silvery white pilose; front tibiae except base and the tarsi blackish; base of the front tibiae, most of the four hind tibiae, and base of tarsi yellowish. Bristles of the legs black. Wings hyaline, the veins and stigma brown and very narrowly bordered pale brown; cell M-3 broadly open in the margin.

Type locality.— Michigan Agricultural College, May 9, 1901.

Type.—Female, in the Cornell University collection.

THEREVA NITORIS Coquillett.

1894. *Thereva nitoris* COQUILLETT, Journ. N. Y. Ent. Soc., vol. 2, p. 101.

The unique female type is the only specimen known. The species is evidently related to the new form described above.

Type locality.—Missouri.

Type.—Female, No. 993, U.S.N.M.

THEREVA BOLBOCERA Osten Sacken.

1887. *Thereva bolbocera* OSTEN SACKEN, Biol. Centr. Amer., Dipt., vol. 1, p. 162.

The third antennal joint is onion-shaped, the frons with a pair of velvety black spots; the wings are described as densely variegated with spots. Judging from the description the antennae are like those figured for *T. novella* on plate 11. The species may prove to be a *Psilocephala* related to *tergissa* and *acuta*.

Type locality.—Presidio, Mexico.

Type.—In the British Museum.

THEREVA CRASSICORNIS Bellardi.

1861. *Thereva crassicornis* BELLARDI, Saggio di Ditterol. Messic., vol. 2, p. 88.

This species has not been reported since described from Mexico. It is a black, yellow marked species. The first antennal joint is described as very long, thick, inflated in the middle, as in *Dialineura*, species. The legs and abdominal markings are as in *T. fucata* Loew, but no mention is made of markings on the wings.

Type locality.—"Mexico."

Type.—In the Bellardi collection, Turin, Italy.

THEREVA RUFICORNIS Macquart.

1840. *Thereva ruficornis* MACQUART, Dipt. Exot., vol. 2, p. 25.

The following is a translation of the original description:

> Black; antennae rufous; apex of abdomen rufous; wings hyaline, the spots fuscous; length 3.1; male.
>
> Face and anterior part of frons black; antennae—the two first joints reddish, the third missing; abdomen—seventh segment and sexual organs reddish; anterior legs reddish brown, tarsi brown, the others are missing; halteres black; wings hyaline; base and exterior border yellowish, veins brown, a small spot of brown at the base of second submarginal and posterior cell.
>
> This species which is placed by the side of the preceding in the collection of the Museum, closely resembles that species and is perhaps a variety of it, yet the differences which distinguish the two are possibly specific.
>
> Carolina. Museum.

Type.—Presumably in the museum, Lille, France.

This species, *Thereva nigra* Say, and the following three species described by Walker, I have not been able to recognize in any of the material examined; no doubt these forms are known under other names. Walker's types are in the British Museum and will in time be redescribed and the synonymy worked out; it is therefore well to give the original descriptions, as they are not easily available. The species are not included in the table of species as this would only cause confusion. Major Austin has kindly furnished notes on the types. Three of the species described in the genus *Thereva* belong to the genus *Psilocephala*. Owing to the poor condition of the types two of the species given below could not be assigned to the genus *Thereva* with certainty.

THEREVA VARIA Walker.

1848. *Thereva varia* WALKER, List Dipt. Brit. Mus., vol. 1, p. 221.

The original description is as follows:

Female.—Fusca, subtus cinerea abdomine fulvo facsiis canis, antennis canis apicis nigris, pedibus fulvis, femorum tibiarum tarsorumque apicibus nigris, alis subcinereis.

Head black and clothed with black hairs, hoary with a tawny tinge in front, thickly clothed with white hairs beneath; feelers hoary with a very slight tawny tinge, black at the tips; mouth black, and clothed with black hairs; chest brown, with yellow hairs; breast gray, with hairs of the same color; abdomen very dark tawny, covered with a white bloom, and clothed with white hairs; fore borders of the segments hoary; underside gray, with a tawny spot on each side of every segment; legs tawny, clothed sparingly with black bristles; tips of the thighs, of the shanks, and of the joints of the feet black; wings slightly gray, darker and with a brownish tinge along the fore border; brands brown; veins piceous; cross veins bordered with brown; poisers tawny, with piceous knobs. Length of the body 3 lines, of the wings 6 lines.

a. Florida. Presented by E. Doubleday, Esq.

Major Austin adds the following notes from the type in the British Museum:

Antennae and one front leg missing, type otherwise in fairly good condition; sides of face hairy; fourth posterior cell widely open. Owing to the absence of the antennae, I am unable to say whether this species is a true *Thereva* in the present-day sense.

THEREVA NERVOSA Walker.

1848. *Thereva nervosa* WALKER, List Brit. Mus., vol. 1, p. 223.

Walker's original description is as follows:

Male.—Niger, abdomine piceo basi subtus ferrugineo, antennis pedibusque fulvis, femoribus cinereis, alis subcinereis, venis fusco marginatis.

Head and chest black; head clothed with black hairs above, and more thickly with white hairs beneath; feelers tawny; first joint very long and thick, and clothed with long black hairs; breast thinly clothed with long white hairs; abdomen piceous, ferruginous beneath toward the base; legs thinly clothed with black bristles and short black hairs; hips and thighs gray; shanks and feet tawny; tips of the feet joints piceous; wings slightly gray, especially at the tips and along the fore borders; brands and veins brown; cross veins bordered with the same color; poisers tawny, with brown knobs. Length of the body 4 lines, of the wings 8 lines.

a. Georgia. From Mr. Abbot's collection.

Major Austin gives the following notes from the type in the British Museum:

Type in very bad condition, greasy and entirely discolored; only three legs, all without terminal joints of tarsi; eyes narrowly separated above. I am unable to say to what genus this species should be assigned.

THEREVA SENEX Walker.

1848. *Thereva senex* WALKER, List Dipt. Brit. Mus., vol. 1, p. 224.

The original description by Walker is as follows:

Female.—Cinerea, capite pectoreque canis, abdomine fasciis ferrugineis, basi piceo, sigmenti 2[1] margine postico cano, antennis pedibusque cinereis, tibiis fulvis, tarsis piceis basi fulvis, alis limpidis.

Head hoary, thickly clothed with white hairs, dark brown between the eyes, behind which there are two or three rows of black bristles; eyes and eyelets red; feelers gray; the first joint furnished with black bristles; mouth piceous: chest gray, thinly clothed with short yellow hairs, and having a few black bristles on each side; breast hoary, more thickly clothed with long white hairs: abdomen gray, clothed with short yellow hairs, which are most thick at the sides of the segments at the base; hind borders of the segments ferruginous; first segment piceous; hind border of second segment hoary; hips and thighs gray, the former thickly clothed with long white hairs, the latter more thinly furnished with short yellow hairs, and having also a few black short bristles; tips of thighs tawny; shanks tawny, with piceous tips, beset with very small black hairs and long black bristles: feet piceous, clothed with short black hairs, and having also black bristles at the tip of each joint; first and second joints tawny, excepting their tips; wings colorless; brands tawny, very narrow; veins tawny along the fore borders, piceous along the hind borders; poisers tawny, piceous toward the tips of the stalks; knobs yellow. Length of the body 5 lines, of the wings 8 lines.

a. Nova Scotia. From Lieutenant Redman's collection.

Major Austin notes that the type in the British Museum is in fairly good condition and that the species is apparently a true *Thereva.*

THEREVA NIGRA Say.

1823. *Thereva nigra* SAY, Journ. Acad. Nat. Sci. Phila., vol. 3, p. 40.
1882. *Psilocephala nigra* VAN DER WULP, Tijd. v. Ent., vol. 25, p. 118.

Say's original description is as follows:

Black, incisures and lateral spot on the fifth segment gray.

Inhabits Pennsylvania.

Head glabrous, polished; hypostoma and all beneath with gray minute hair; antennae with minute gray hair, and longer sparse black hair on the basal joint; occiput velvet black; wings pellucid, stigmata and nervures brown, costal edge beyond the stigma pale, each of the two ultimate pairs of nervures uniting before they attain the edge of the wing; poisers brown; scapus pale; pleura, pectus, and coxae somewhat glaucous; feet blackish, tibiae and tarsi excepting at tip pale, anterior tibia at tip and tarsi blackish; tergum polished, posterior edges of the third or fourth basal segments gray, spot each side of the fifth segment oblong-oval oblique.

Length 0.3 of an inch (about 8 mm.).

The type is destroyed and it is probable that the identity of this species will never be known. Coquillett considered it a true *Thereva,* and various species of *Psilocephala* and *Thereva* have been placed under the name by other dipterists. The description sounds like a *Psilocephala* related to *haemorrhoidalis* and prehaps Kröber is correct in his supposition that Say had before him what we now know as *Psilocephala haemorrhoidalis* when he described this species.

Kröber redescribes *Thereva nigra* Say in his 1914 paper. He holds that *T. melanoneura* Loew is identical with *T. nigra* and describes that species for *nigra*. There were five males and one female in the material, from Colorado and Flagstaff, Arizona. The writer has stated above that Say's description of *nigra* is unrecognizable. It is certainly not *melanoneura*, which is typically a southwestern species and at the time that Say was describing diptera this region was Indian country and practically unexplored.

Two of the species described by Kröber in 1914 are redescribed by the writer in the foregoing pages; one of these species, *T. bella*, was kindly determined by C. W. Johnson, the other, *T. niveipennis*, was originally described as a new species. Translations of the descriptions of the four other species of *Thereva* are given below.

THEREVA NIVEA Kröber.

1914. *Thereva nivea* KRÖBER, Beiheft z. Jahrb. Hamb. Wiss. Anstalten, vol. 31, p. 64.

Male.—Length 9 mm. Very near *T. semitaria* Coquillett. Dense snow white pilose, without silvery reflections. The mesonotum and antennae are as in *T. semitaria*. The halteres are almost white. The legs are wholly pale yellowish brown, the femora thick white pilose. The anal segment is reddish yellow. The wings are tinged pale yellowish brown, the stigma not apparent.

Type locality.—Mesilla Valley, New Mexico, April 19.

Type.—In the United States National Museum, Cat. No. 26028.

THEREVA METALLICA Kröber.

1914. *Thereva metallica* KRÖBER, Beiheft z. Jahrb. Hamb. Wiss. Anstalten, vol. 31, p. 68.

Male.—Length 8 mm. A species with long wooly white pile. The head is strongly metallic, white, shining, only the frontal triangle itself shining black. The pile of the face is unusually long, blackish brown, the face with very long snow white pile. The first antennal joint is very long bristled, above with black, below with white bristles; second and third antennal joints more reddish, gray tomentose. The occiput is gray, on the eye margin silvery white.

The mesonotum is black in ground color, dull, with two whitish gray, narrow longitudinal vittae. The scutellum is black, gray dusted. The pile of the mesonotum is unusually long, sparse, erect, snow white. The pleura are so thickly white pilose that the ground color is not visible. The abdomen, viewed from in front, is pure metallic silvery white, with an intense glitter, as with no other species; the pile is long, snow white, sparse. The anal lamellae are reddish yellow. The borders of the tergites are not visible. The venter is black, sparsely gray dusted, the second segment with a whitish border; the pile is long, sparse, white. The halteres are black.

The femora are black, with long but sparse white pile; the tibiae and tarsi are pale yellowish brown, the apices hardly darkened at all. The wings are pure hyaline, the stigma brownish, the veins thin and the upper fork of the third vein turned upward.

Type locality.—Las Vegas Hot Springs, New Mexico, May 17.

Type.—In the United States National Museum, Cat. No. 26029.

THEREVA CONCAVIFRONS Kröber.

1914. *Thereva concavifrons* KRÖBER, Beiheft z. Jahrb. Hamb. Wiss. Anstalten, vol. 31. p. 70.

Female.—Length 12 mm. The head is almost golden yellow tomentose, the face becoming whitish, the vertex merging to brownish; between the two colors is a dull black band which reaches from one eye to the other, slightly bulging and quite far from the ocelli; in certain lighting it disappears; in this case below the lowest ocellus a similar band appears, which however is far from the eye margin. This band is the margin of a quite noticeable frontal concavity. The first antennal joint is black, gray tomentose, the second with a brownish tone, the third pure brown, reddish at the base.

The mesonotum is brownish yellow tomentose, with thick close-lying, golden yellow, almost wooly pile. The scutellum appears to be reddish, with tomentum and pile like the thorax. The mesonotum has two faint stripes and a brown median vitta. The pleura are light gray, very sparsely brassy yellow pilose. The halteres are brownish, with a reddish yellow stem.

The abdomen is shining reddish yellow, the second to the fifth tergites with more or less rounded off, shining black anterior marginal spots. The venter is plain reddish yellow, the second to the fourth segments with faint, silky borders as on the upper side. The legs are wholly reddish yellow, the tarsi hardly darkened at all. The wings are tinged pale brownish, the veins noticeably bordered, the stigma very faint.

Type locality.—Rio Ruidoso, New Mexico.

Type.—In the United States National Museum, Cat. No. 26026.

THEREVA FLAVOHIRTA Kröber.

1914. *Thereva flavohirta* KRÖBER, Beiheft z. Jahrb. Hamb. Wiss. Anstalten, vol. 31, p. 70.

Female.—Length 12.5 mm. Very near *T. flavicauda* Coquillett and *duplicis* Coquillett. The antennae are wholly pale yellowish red. The callosity consists of two shining black, quite convex spots. The pile of the antennae and the face pale reddish yellow.

The mesonotum is sparsely grayish yellow pilose. The legs are wholly pale yellowish red, the last tarsal joint scarcely darkened. Abdomen on the first to the fourth segment largely blackish gray.

with broad, reddish yellow posterior margins; the following segments are largely shining reddish yellow, more or less blackish at the bases; the pile of the abdomen is light reddish yellow.

The halteres are pale reddish yellow. The wings are tinged deep yellowish, the veins strong, partly, especially on the fork of the third vein, blackish. The stigma of the wing is not plain.

Type locality.—Colorado.

Type.—In the United States National Museum, Cat. No. 26027.

REFERENCES TO LITERATURE ON NORTH AMERICAN THEREVIDAE.

1821. Wiedemann, Dipt. exot., pp. 112–114 (two species described from Georgia).

1823. Say, Journ. Acad. Nat. Sci. Phila., vol. 3, pp. 39–40 (description of *Thereva nigra*).

1824. Say, Long's Exped. to St. Peter's River, vol. 2, Append., p. 370 (description of *Thereva frontalis*).

1828. Wiedemann, Aussereurop. zweifl. Ins., vol. 1, pp. 235–236 (notes on North American species).

1829. Say, Journ. Acad. Nat. Sci. Phila., vol. 6, p. 156 (description of *Thereva albifrons*).

1840. Macquart, Dipt. exot., vol. 2, pt. 1, pp. 24–26 (description of *Thereva ruficornis* and *T. haemorrhoidalis*).

1848. Walker, List Dipt. Brit. Mus., vol. 1, pp. 221–224 (six species of *Thereva* are described, three really belonging to *Psilocephala*).

1852. Walker, Insecta Saunders., Dipt., vol. 1, p. 197 (description of *Tabuda fulvipes*).

1861. Bellardi, Saggio di Ditterol. Messic., vol. 2, pp. 88–92 (four species are described from Mexico).

1862. Evett, Proc. Ent. Soc. Phila., vol. 1, p. 217 (record of *Tabuda fulvipes*).

1867. Schiner, Reise der Novara, Dipt., pp. 145–146 (remarks on the genera of the world and descriptions of several new species, none from North America).

1869. Loew, Berlin. Ent. Zeitschr., vol. 13, pp. 7–12 (10 North American species described).

1869. Loew, Berlin. Ent. Zeitschr., vol. 13, pp. 166–172 (four North American species described).

1872. Loew, Berlin. Ent. Zeitschr., vol. 16, p. 74 (new species described).

1874. Loew, Berlin. Ent. Zeitschr., vol. 18, p. 382 (*Thereva hirticeps* described).

1876. Loew, Zeitschr. f. d. ges. Naturwiss., vol. 47, p. 319 (description of *Psilocephala laevigata*, *P. platancala*, and *Thereva melanophleba*).

1877. Osten Sacken, Bull. U. S. Geol. Surv., vol. 3, p. 274 (description of *T. vialis* and notes on other western species).

1878. Osten Sacken, Cat. Dipt. N. America, ed. 2, pp. 96 and 239 (lists the species and gives notes on Walker's species).

1886. Williston, Trans. Amer. Ent. Soc., vol. 13, p. 294 (description of *Thereva crassicornis*).

1887. Osten Sacken, Biol. Centr. Amer. Dipt., vol. 1, p. 162 (description of *T. bolbocera* and a list of the previously described species from Mexico).

1889. Bigot, Ann. Ent. Soc. France, ser. 6, vol. 9, p. 321 (description of *Osodiceromyia mexicana*).

1893. Coquillett, Can. Ent., vol. 25, pp. 197–201 (a synopsis of the genus *Thereva* with a table of species and descriptions of five new species).

1893. Coquillett, Can. Ent., vol. 25, pp. 222–229 (a synopsis of the genus *Psilocephala* with a table of species and descriptions of five new forms).

1894. Coquillett, Journ. New York Ent. Soc., vol. 2, pp. 97–101 ("A Revision of the Dipterous Family Therevidae." The genera *Metaphragma* and *Nebritus* are erected and six new species described in all).

1898. Coquillett, Journ. New York Ent. Soc., vol. 6, p. 187 (description of *Henicomyia hubbardi*).

1901. Williston, Biol. Centr. Amer. Dipt., vol. 1, p. 297 (in the supplement notes on two species are given).

1902. Johnson, Can. Ent., vol. 34, p. 241 (description of *P. grandis*).

1903. Aldrich, Catalogue Dipt. of N. America, pp. 246–249 (lists 6 genera and 71 species).

1903. Adams, Kans. Univ. Sci. Bull., vol. 2, p. 222 (description of *P. acuta*).

1904. Adams, Kans. Univ. Sci. Bull., vol. 2, pp. 443–444 (in a paper on new diptera three new Therevids are described).

1904. Coquillett, Proc. Ent. Soc. Wash., vol. 6, p. 91 (in a paper on Central American diptera describes *P. pruinosa*).

1904. Coquillett, Proc. Ent. Soc. Wash., vol. 6, p. 177 (in a paper on new diptera describes *P. aurantiaca*).

1904. Coquillett, Invertebr. Pac., vol. 1, p. 23 (in a list of Californian and Nevadan diptera by C. F. Baker *Thereva flavicauda* is described).

1908. Williston, Manual of North American Diptera, pp. 205–207 (gives a general account of the family with a table of genera).

1909. Cockerell, Bull. Amer. Mus. Nat. Hist., vol. 26, p. 10, and the same volume, p. 68 (descriptions of two fossil species of Therevidae).

1910. Hyslop, Proc. Ent. Soc. Wash., vol. 12, p. 98 (notes on early stages of *Thereva egressa*).

1912. Kröber, Stett. Ent. Zeitg., vol. 73, pp. 209–272. A revision of the Therevidae of North America (tables of species for *Thereva* and *Psilocephala* and several new species described).

1912. Felt, New York State Mus. Bull., no. 155, p. 121 (larva and pupa of *P. melampodia* described).

1913. Kröber, Genera Insectorum, p. 148, 66 pages and 3 plates (the genera and species of the Therevidae of the world with tables and generic diagnoses).

1913. Johnson, Bull. Amer. Mus. Nat. Hist., vol. 32, art. 3, pp. 58–59 (in a list of the diptera of Florida records 13 Therevids, including *P. obscura* Coquillett).

1914. Kröber, Beiheft z. Jahrb. Hamb. Wiss. Anstalten, vol. 31, p. 64 (describes 14 new species from North America and gives notes an others).

1915. Malloch, Bull. Ill. Lab. Nat. Hist., vol. 11, p. 324 (notes on larva and pupa of *P. haemorrhoidalis*).

1917. Malloch, Bull. Ill. Lab Nat. Hist., vol. 12, pp. 296–398 (a short account of the family characters and biology).

1920. Cockerell, Proc. U. S. National Museum, vol. 57, p. 251 (in a paper on fossil insects describes a new genus and species of Therevidae).

EXPLANATION OF PLATES.

All the figures were drawn by the author from specimens examined under the binocular microscope.

Plate 1.

Fig. 1.—*Caenotus inornatus*, new species. Antenna.
2.—*C. inornatus*, new species. Female.
3.—*C. inornatus*, new species. Genitalia of male.
4.—*C. minutus*, new species. Male.

Plate 2.

Fig. 5.—*Henicomyia hubbardi* Coquillett. Dorsal view of male.
6.—*H. hubbardi* Coquillett. Antenna.
7.—*H. hubbardi* Coquillett. Lateral view of male.

Plate 3.

Fig. 8.—*Nebritus pellucidus* Coquillett. Antenna.
9.—*N. pellucidus* Coquillett. Female.
10.—*N. pellucidus* Coquillett. Male genitalia.
11.—*Pherocera signatifrons*, new species. Antenna.
12.—*P. signatifrons*, new species. Female.
13.—*P. signatifrons*, new species. Head.
14.—*P. flavihalteralis*, new species. Front of head.
15.—*P. flavipes*, new species. Front of head.
16.—*Chromolepida bella*, new species. Front of head
17.—*C. bella*, new species. Antenna.
18.—*C. bella*, new species. Genitalia.

Plate 4.

Fig. 19.—*Epomyia rufiventris* (Loew.) Wing of female.
20.—*E. pictipennis* (Wiedemann). Front of head of female.
21.—*E. bella*, new species. Front of head of female.
22.—*E. pictipennis* (Wiedemann). Wing of female.
23.—*E. sumichrasti* (Bellardi). Wing of female.
24.—*E. sumichrasti* (Bellardi). Front of head of female.
25.—*E. rufiventris* (Loew). Front of head of female.
26.—*E. scutellaris* (Loew). Front of head of female.
27.—*E. bella*, new species. Wing of female.
28.—*E. pictipennis* (Wiedemann). Front and middle tibiae and tarsi.
29.—*E. scutellaris* (Loew). Wing of female.
30.—*E. scutellaris* (Loew). Antenna.
31.—*E. bella*, new species. Antenna.
32.—*E. sumichrasti* (Bellardi). Antenna.
33.—*E. sumichrasti* (Bellardi). Male genitalia.
34.—*E. pictipennis* (Wiedemann). Male genitalia.
35.—*E. scutellaris* (Loew). Male genitalia.
36.—*E. pictipennis* (Wiedemann). Antenna.
37.—*E. rufiventris* (Loew). Antenna.

PLATE 5.

Fig. 38.—*Psilocephala aldrichi* Coquillett. Female.
39.—*P. aldrichi* Coquillett. Male.

PLATE 6.

Fig. 40.—*Psilocephala morata* Coquillett. Female.
41.—*P. flavipennis*, new species. Female.
42.—*P. aldrichi* Coquillett. Female.
43.—*P. frontalis*, new species. Female.
44.—*P. platancala* Loew. Female.
45.—*P. placida* Coquillett. Female.
46.—*P. munda* Loew. Female.
47.—*P. haemorrhoidalis* (Macquart). Female.
48.—*P. haemorrhoidalis* (Macquart). Male.
49.—*P. limata* Coquillett. Female.
50.—*P. tergissa* (Say). Female.
51.—*P. pavida* Coquillett. Female.
52.—*P. aurantiaca* Coquillett. Female.
53.—*P. canadensis*, new species.
54.—*P. melampodia* Loew. Female.
55.—*P. laevigata* Loew. Female.
56.—*P. marcida* Coquillett. Female.
57.—*P. acuta* Adams. Female (from cotype).
58.—*P. arizonensis*, new species. Female.
59.—*P. variegata flavipilosa*, new subspecies. Female.
60.—*P. cinerea*, new species.
61.—*P. latifrons*, new species. Male.
62.—*P. lateralis* Adams. Female.
63.—*P. costalis* Loew. Female.
64.—*P. argentifrons*, new species. Male.
65.—*P. fuscipennis*, new species. Female.

PLATE 7.

FIG. 66.—*Psilocephala tergissa* (Say).
67.—*P. acuta* Adams.
68.—*P. festina* Coquillett.
69.—*P. flavipennis*, new species.
70.—*P. aurantiaca* Coquillett.
71.—*P. limata* Coquillett.
72.—*P. cinerea*, new species.
73.—*P. munda* Loew.
74.—*P. costalis* Loew.
75.—*P. notata* (Wiedemann).
76.—*P. platancala* Loew.
77.—*P. pavida* Coquillett.
78.—*P. variegata occidentalis*, new subspecies.

PLATE 8.

FIG. 79.—*Psilocephala marcida* Coquillett. Antenna; 97, male genitalia.
80.—*P. variegata flavipilosa*, new subspecies. Antenna.
81.—*P. munda* Loew. Antenna; 96, male genitalia.
82.—*P. festina* Coquillett. Antenna; 106, male genitalia.
83.—*P. morata* Coquillett. Antenna; 105, male genitalia.

FIG. 84.—*P. pavida* Coquillett. Antenna; 98, male genitalia.
85.—*P. notata* (Wiedemann). Antenna.
86.—*P. limata* Coquillett. Antenna; 101, male genitalia.
87.—*P. acuta* Adams. Antenna.
88.—*P. baccata* Coquillett. Antenna.
89.—*P. melampodia* Loew. Antenna.
90.—*P. platancala* Loew. Antenna.
91.—*P. aurantiaca* Coquillett. Antenna.
92.—*P. pollinosa*, new species. Antenna.
93.—*P. signatipennis*, new species. Antenna.
94.—*P. argentifrons*, new species. Antenna.
95.—*P. cinerea*, new species. Antenna.
96.—*P. munda* Loew. Male genitalia.
97.—*P. marcida* Coquillett. Male genitalia, lateral and ventral views.
98.—*P. pavida* Coquillett. Male genitalia.
99.—*P. costalis* Loew. Male genitalia.
100.—*P. argentifrons*, new species. Male genitalia.
101.—*P. limata* Coquillett. Male genitalia.
102.—*P. variegata occidentalis*, new subspecies. Male genitalia.
103.—*P. signatipennis*, new species. Male genitalia.
104.—*P. aurantiaca* Coquillett. Male genitalia.
105.—*P. morata* Coquillett. Male genitalia.
106.—*P. festina* Coquillett. Male genitalia.
107.—*P. flavipennis*, new species. Male genitalia.

PLATE 9.

FIG. 108.—*Dialineura melanophleba* (Loew). Wing.
109.—*D. crassicornis* (Williston). Male.
110.—*D. crassicornis* (Williston). Genitalia.
111.—*D. melanophleba* (Loew). Male genitalia.
112.—*D. melanophleba* (Loew). Head of male (higher magnification than 113 and 114).
113.—*Tabuda fulvipes* Walker. Head of male.
114.—*T. borealis*, new species. Head of male.
115.—*T. fulvipes* Walker. Male genitalia.
116.—*T. borealis*, new species. Male genitalia.
117.—*T. fulvipes* Walker. Wing.

PLATE 10.

All figures other than 118 show the female head from above.

FIG. 118.—*Metaphragma planiceps* (Loew). Male.
119.—*Thereva johnsoni* Coquillett.
120.—*T. brunnea*, new species.
121.—*T. frontalis* Say
122.—*T. duplicis* Coquillett.
123.—*T. vanduzeei*, new species.
124.—*T. otiosa* Coquillett.
125.—*T. melanoneura* Loew.
126.—*T. hirticeps* Loew.
127.—*T. pygmaea*, new species.
128.—*T. semitaria* Coquillett.
129.—*T. vialis* Osten Sacken.
130.—*T. candidata* Loew.
131.—*T. comata* Loew.

PLATE 11.

FIG. 132.—*Thereva pseudoculata*, new species. Antenna.
133.—*T. pacifica*, new species. Antenna.
134.—*T. niveipennis* Kröber. Antenna.
135.—*T. vanduzeei*, new species. Antenna.
136.—*T. flavipilosa*, new species. Antenna.
137.—*T. bella* Kröber. Antenna.
138.—*T. semitaria* Coquillett. Antenna.
139.—*T. novella* Coquillett. Antenna.
140.—*T. vialis* Osten Sacken. Antenna.
141.—*T. otiosa* Coquillett. Antenna.
142.—*T. johnsoni* Coquillett. Antenna.
143.—*T. pygmaea*, new species. Antenna.
144.—*T. pygmaea*, new species. Male genitalia.
145.—*T. melanoneura* Loew. Male genitalia.
146.—*T. cockerelli*, new species. Male genitalia.
147.—*T. vialis* Osten Sacken. Male genitalia.
148.—*T. duplicis* Coquillett. Male genetalia.
149.—*T. candidata* Loew. Male genetalia.
150.—*T. frontalis* Say. Male genitalia.
151.—*T. comata* Loew. Male genitalia.
152.—*T. brunnea*, new species. Male genitalia.
153.—*T. pseudoculata*, new species. Male genitalia.
154.—*T. fucata* Loew. Male genitalia.
155.—*T. cingulata* Kröber. Male genitalia.

PLATE 12.

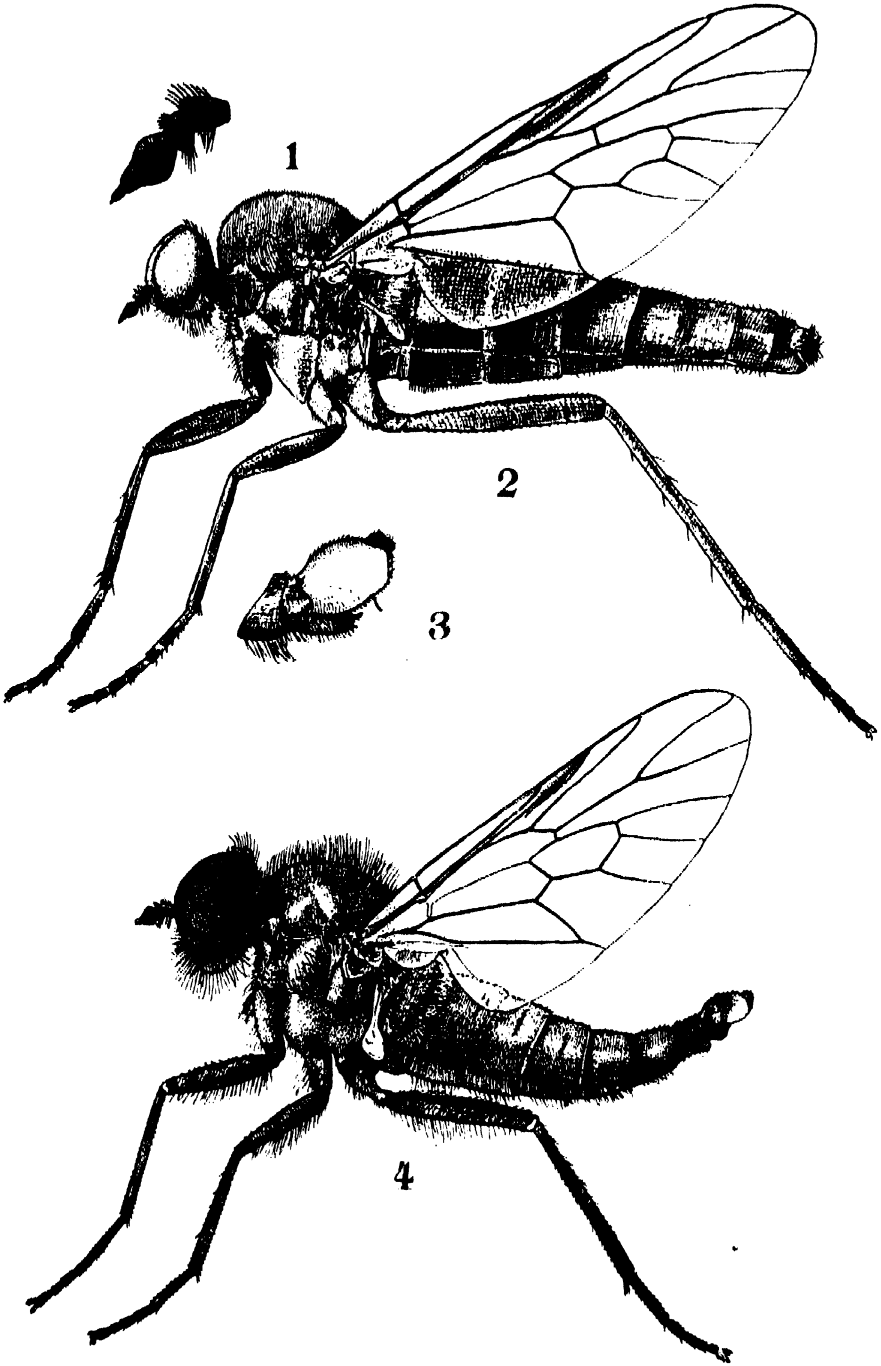
Wings of various species of *Thereva*.

FIG. 156.—*Thereva melanoneura* Loew.
157.—*T. vanduzeei*, new species.
158.—*T. vialis* Osten Sacken.
159.—*T. duplicis* Coquillett.
160.—*T. niveipennis* Kröber.
161.—*T. comata* Loew.
162.—*T. fucata* Loew.
163.—*T. bakeri*, new species.
164.—*T. brunnea*, new species.
165.—*T. pygmaea*, new species.
166.—*T. hirticeps* Loew.
167.—*T. otiosa* Coquillett.

PLATE 13.

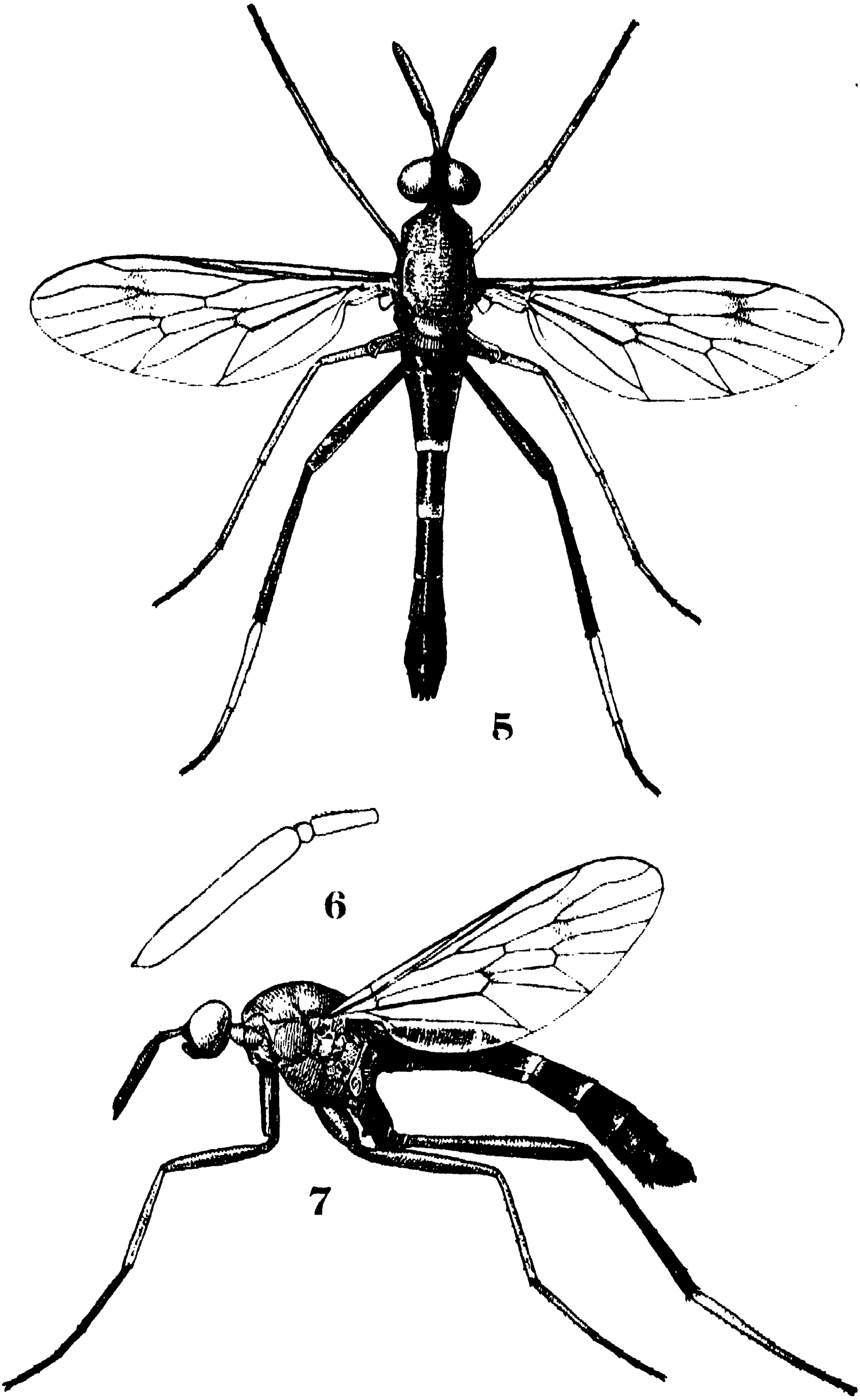
Early stages of Therevidae.

Fig. 168.—Larva of *Psilocephala frontalis*, new species.
169.—Head and prothorax of same, greatly enlarged.
170.—Pupa of *P. frontalis*.
171.—Anterior part of pupa of *P. haemorrhoidalis* (Macquart), showing split made by emerging adult.
172.—Posterior portion of same, showing the arrangement of spines.
173.—Pupa of *Psilocephala limata* Coquillett.
174.—Pupa of *P. argentifrons*, new species.



NORTH AMERICAN FLIES OF THE FAMILY THERIVIDAE.

FOR EXPLANATION OF PLATE SEE PAGE 138.



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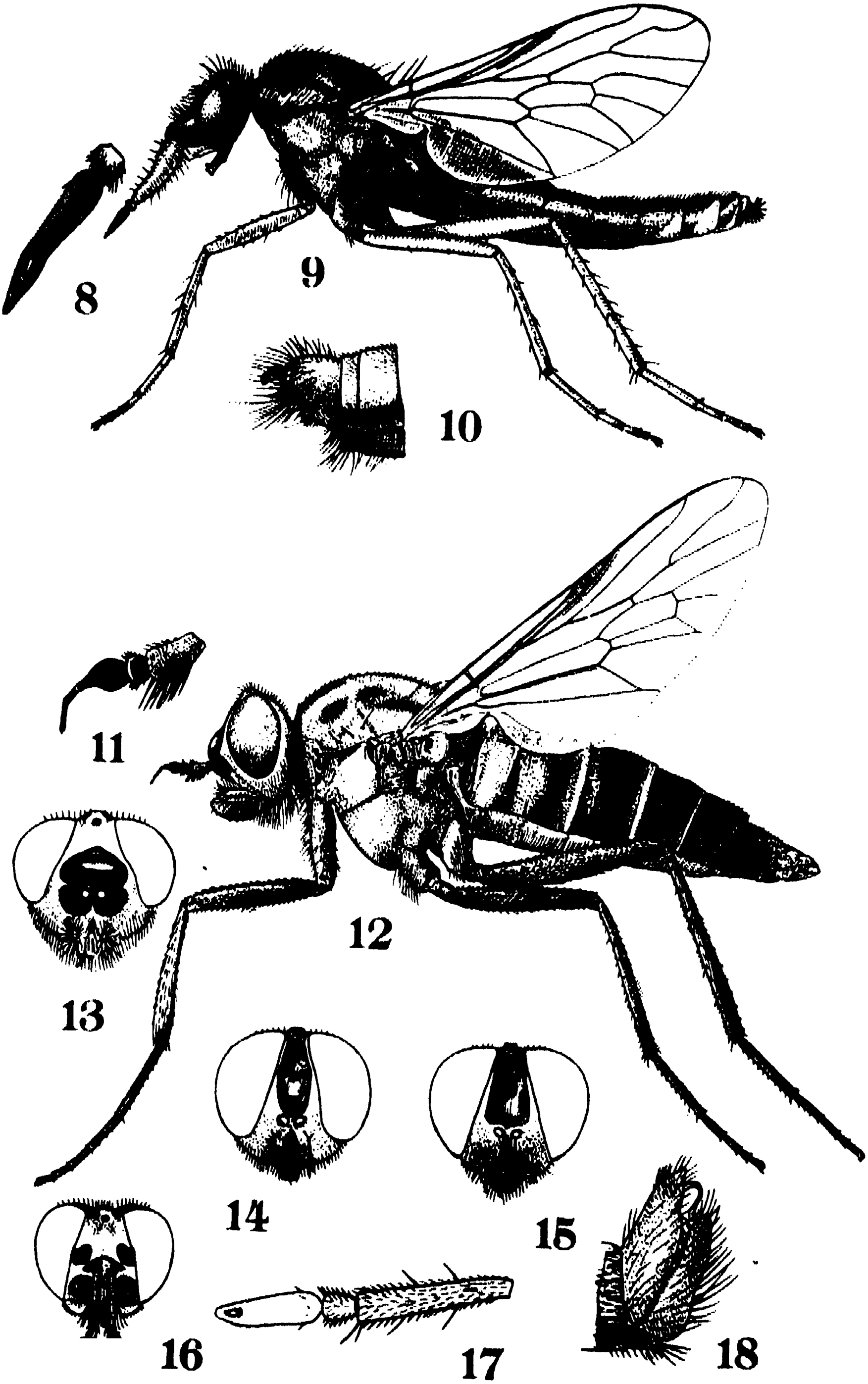

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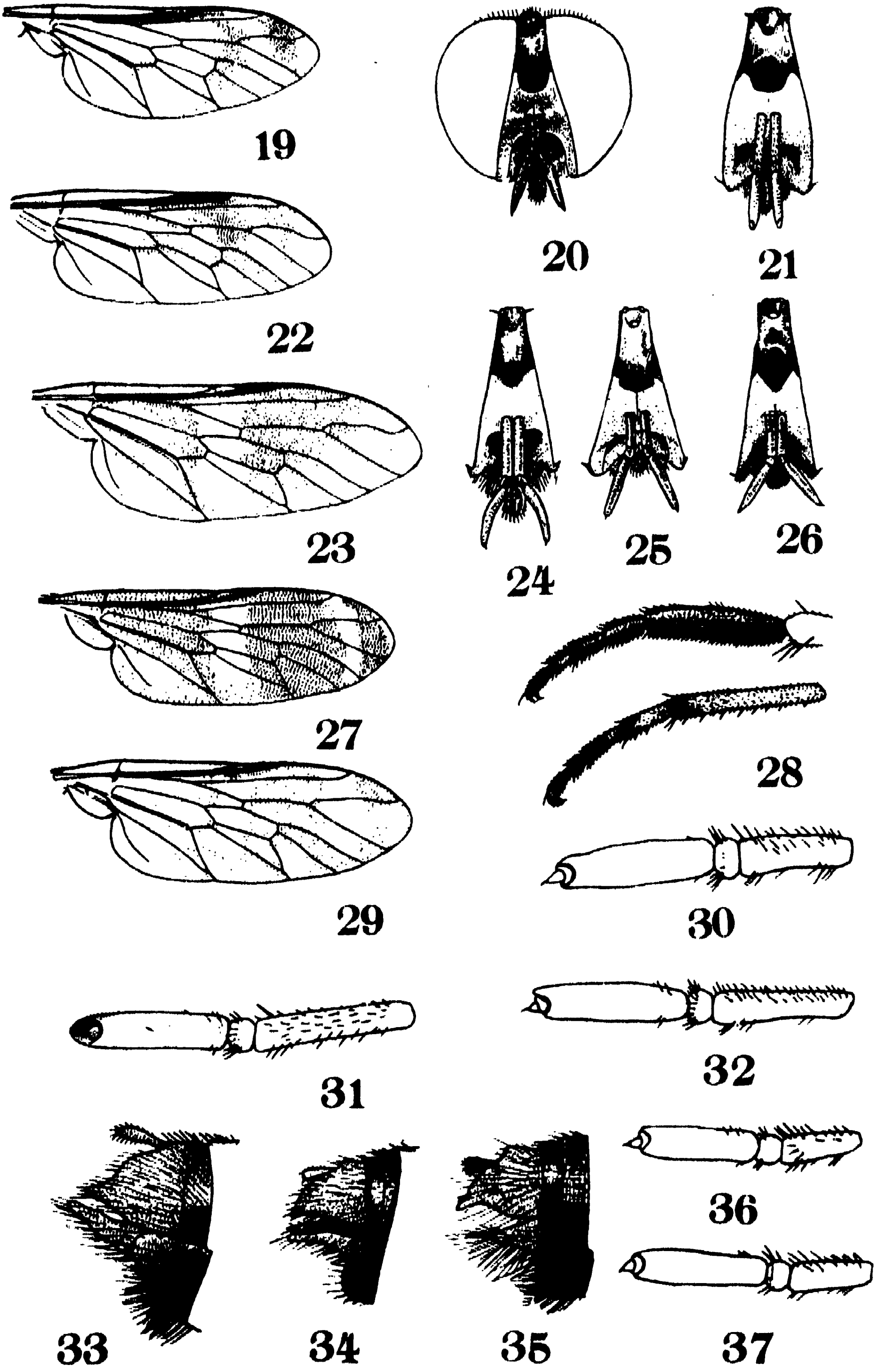

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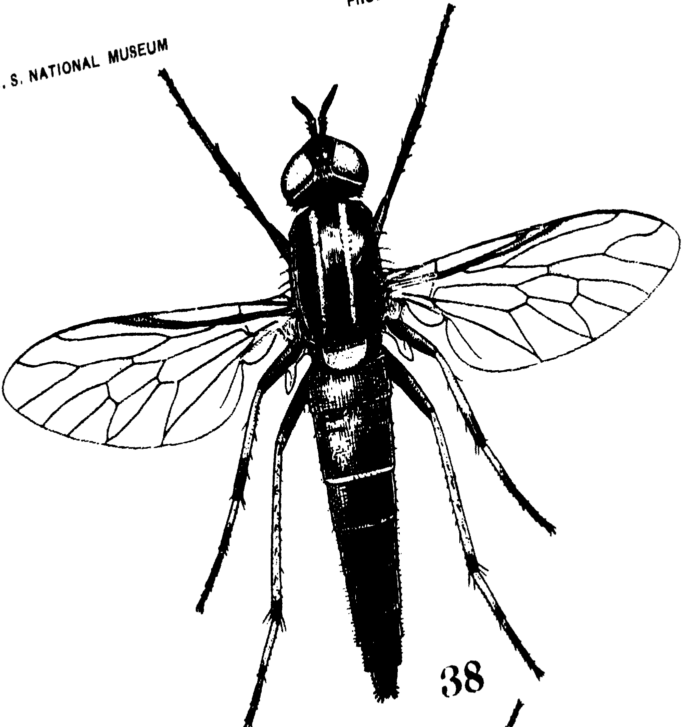

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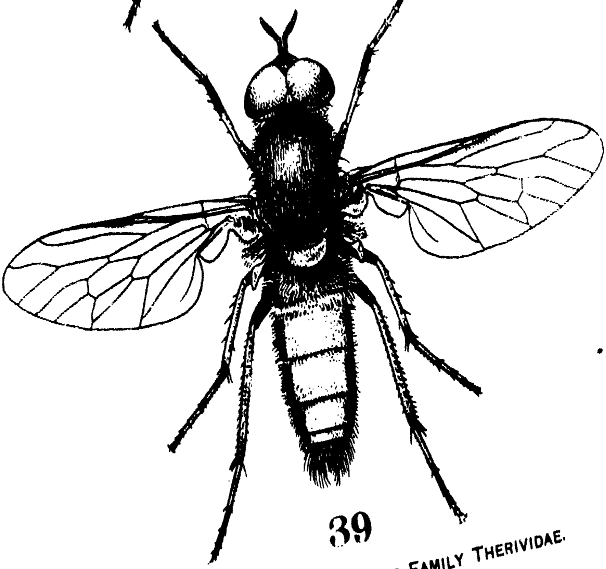

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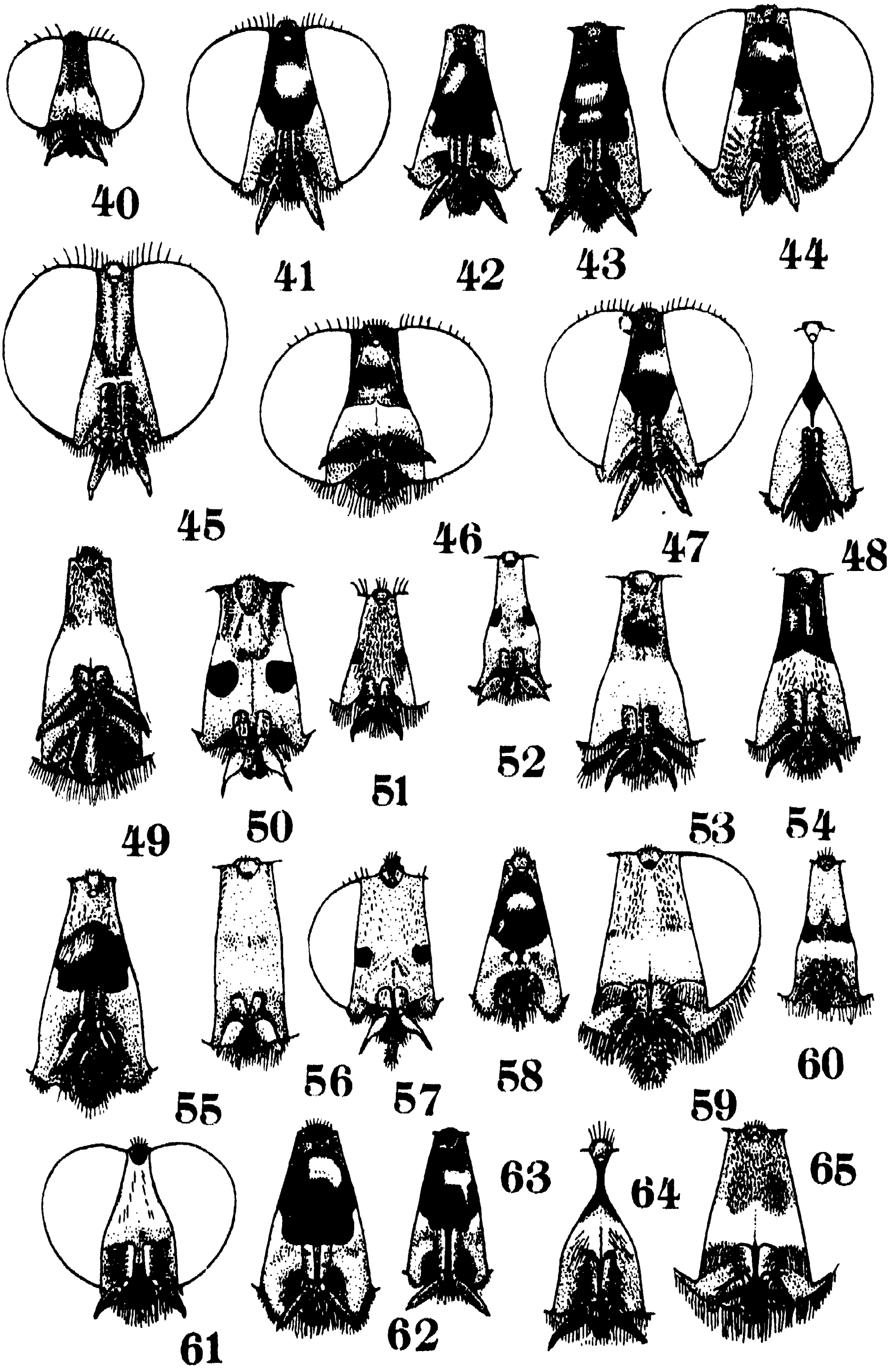

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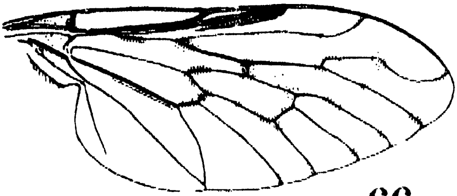

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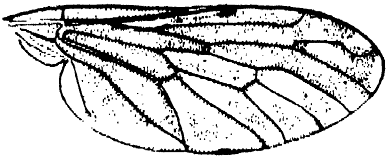

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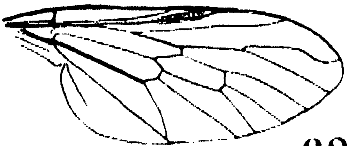

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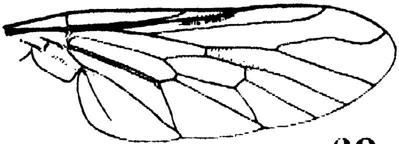

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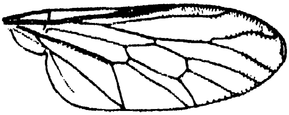

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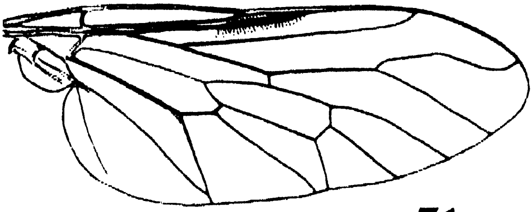

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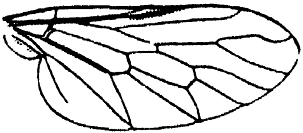

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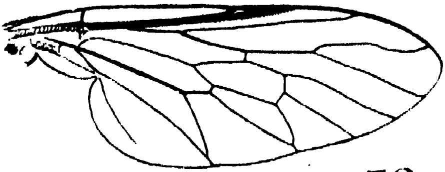

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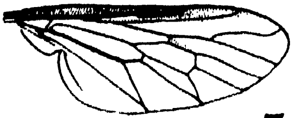

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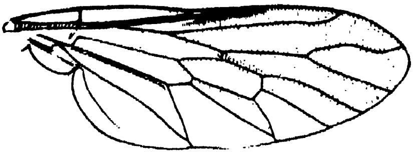

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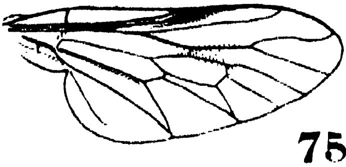

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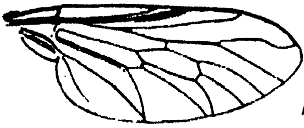

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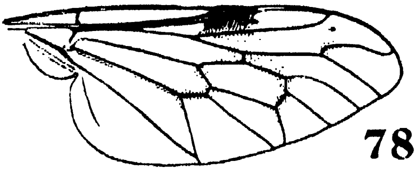

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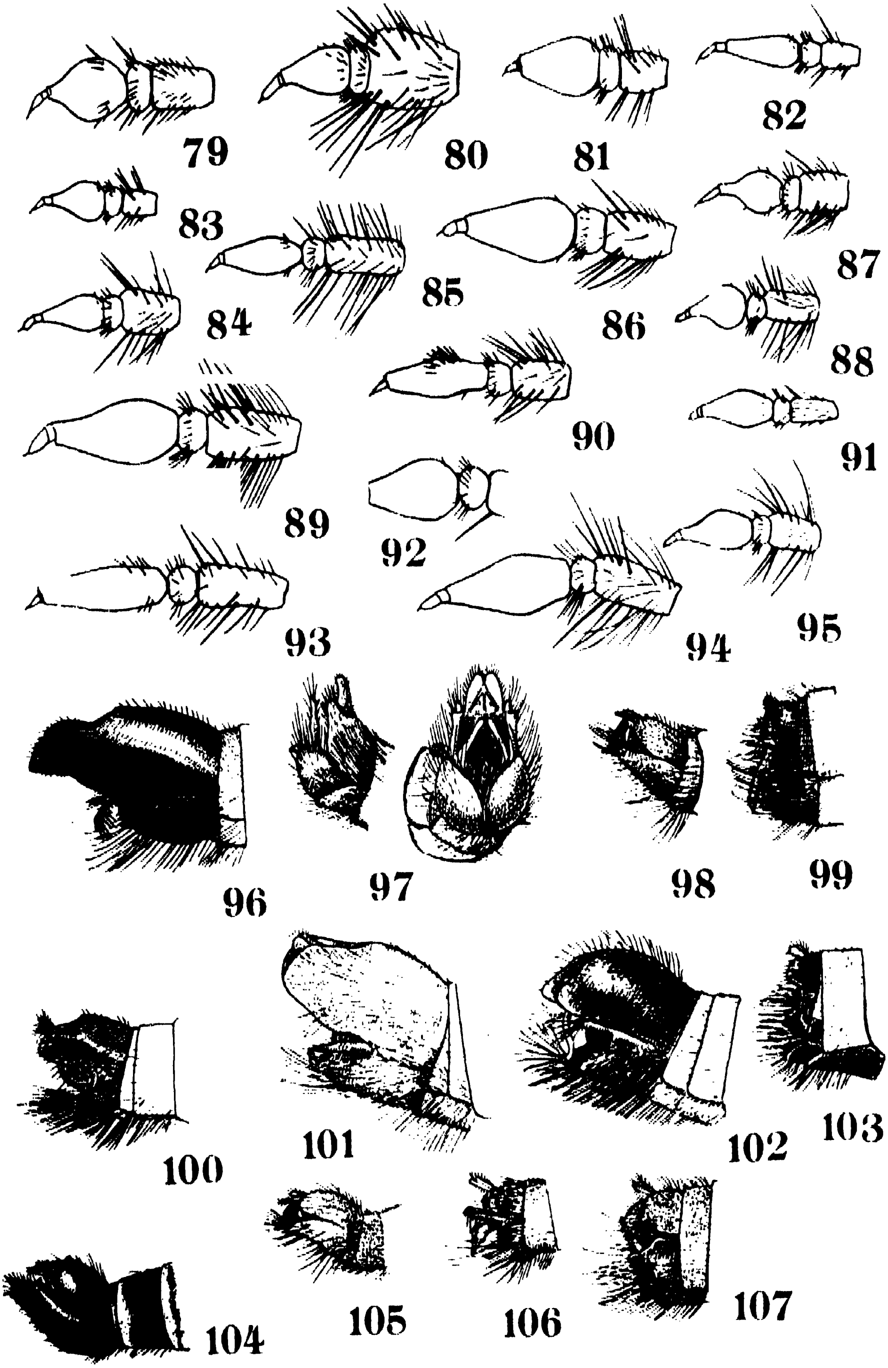
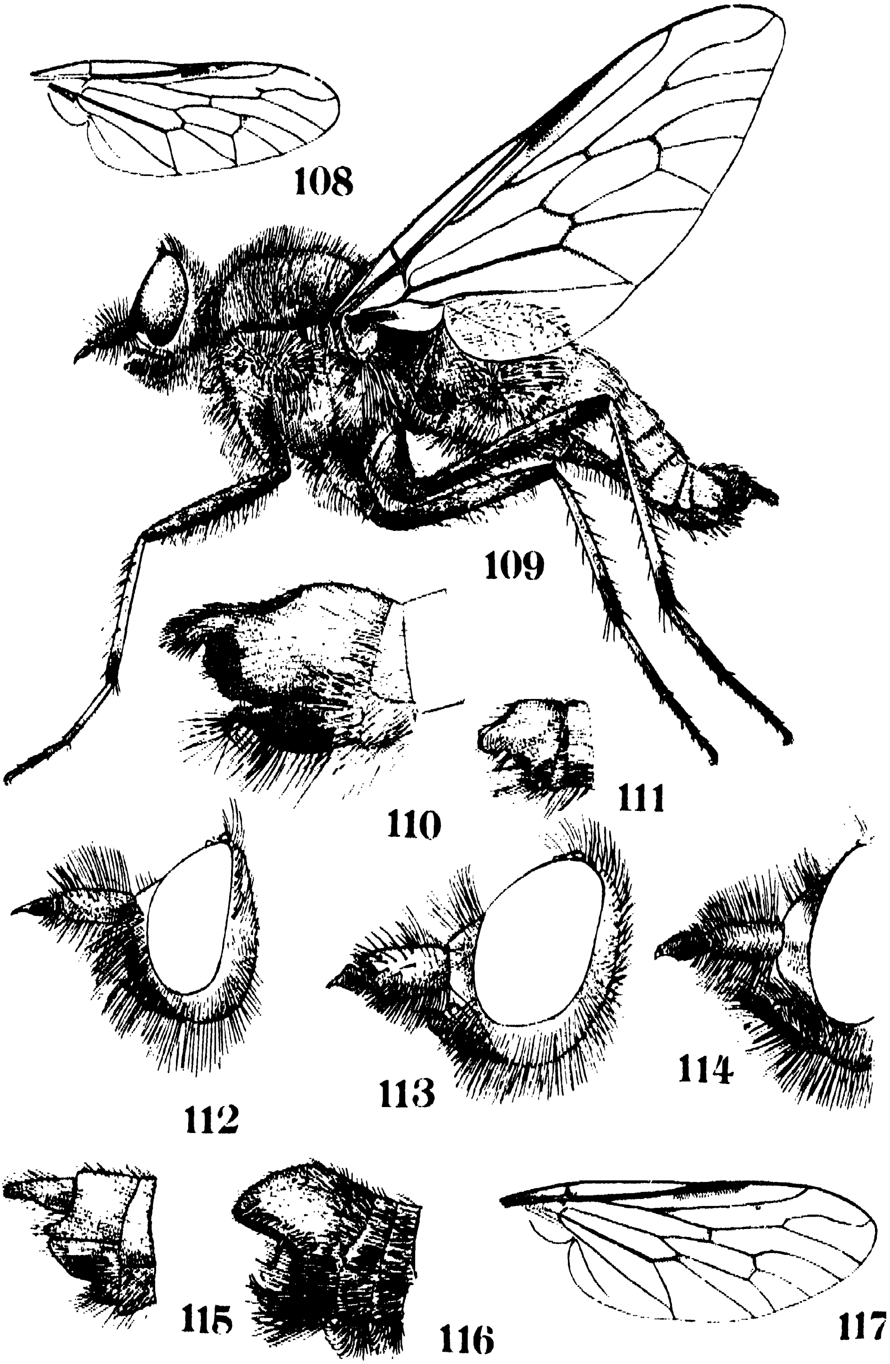
NORTH AMERICAN FLIES OF THE FAMILY THERIVIDAE.

FOR EXPLANATION OF PLATE SEE PAGE 138



NORTH AMERICAN FLIES OF THE FAMILY THERIVIDAE.

FOR EXPLANATION OF PLATE SEE PAGES 136 AND 137.



NORTH AMERICAN FLIES OF THE FAMILY THERIVIDAE.

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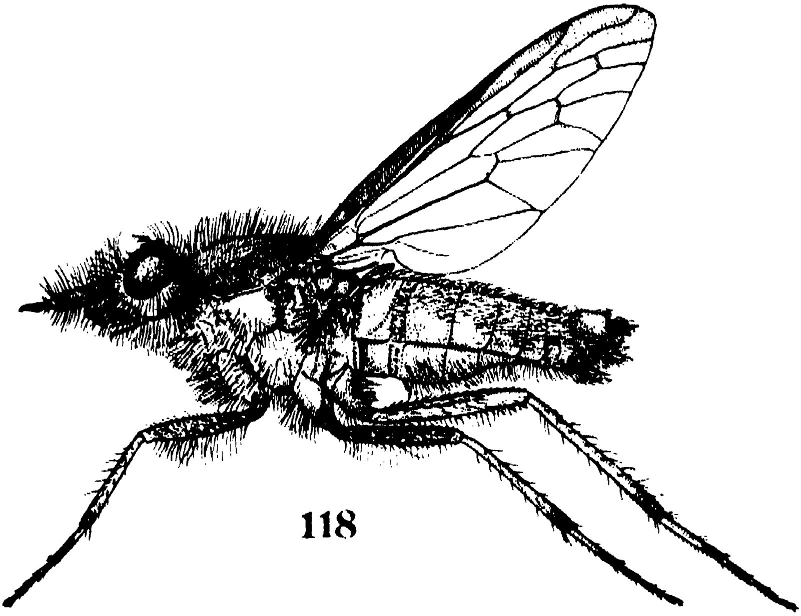

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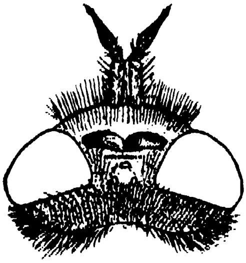

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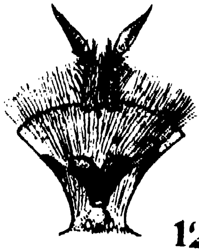

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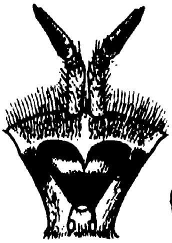

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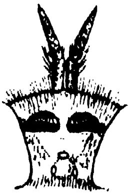

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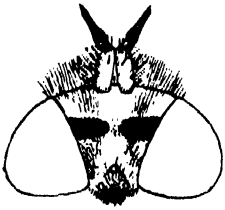

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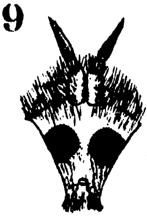

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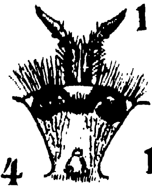

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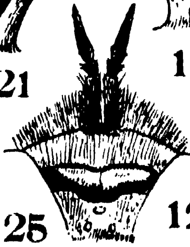

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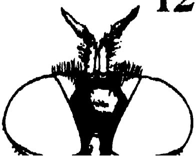

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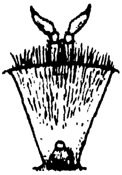

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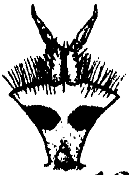

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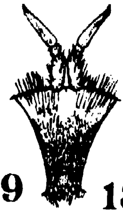

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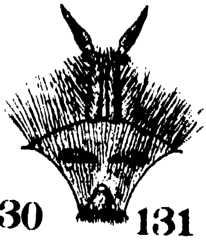

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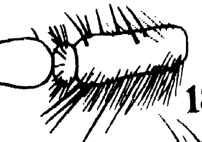
NORTH AMERICAN FLIES OF THE FAMILY THERIVIDAE.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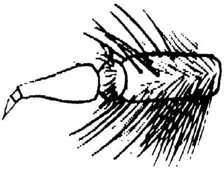
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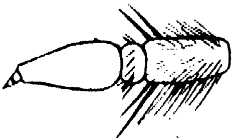
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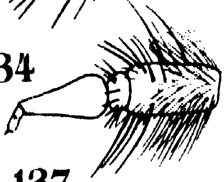
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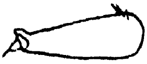
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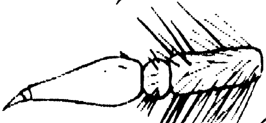
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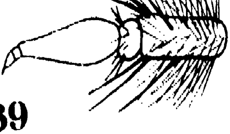
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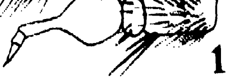
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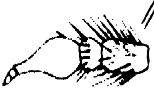
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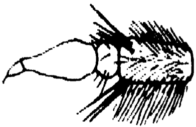
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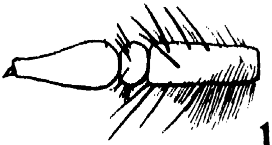
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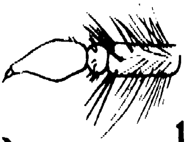
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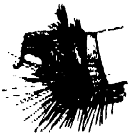
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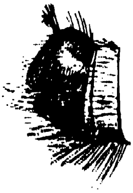
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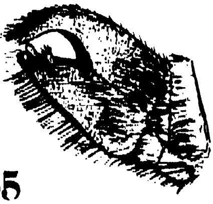
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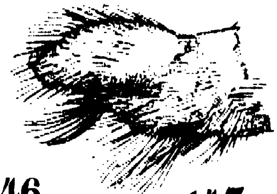
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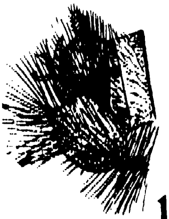
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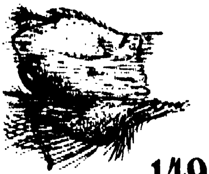
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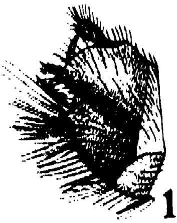
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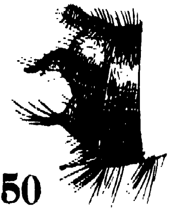
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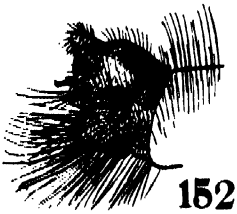
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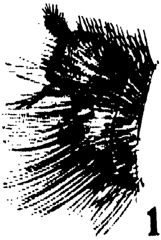
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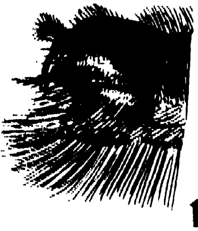
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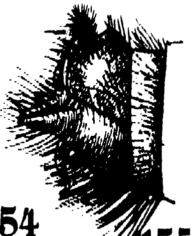
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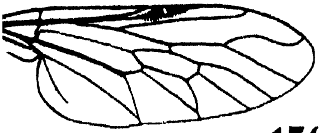

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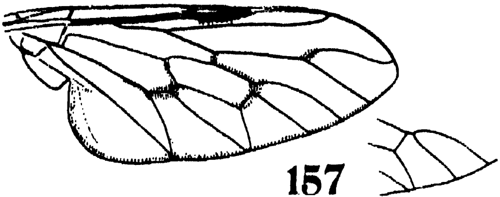

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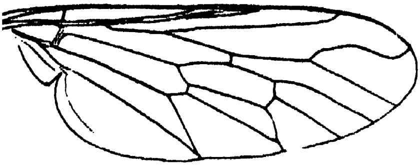

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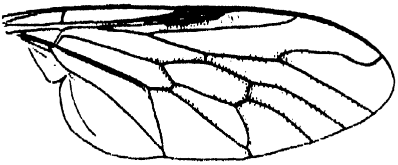

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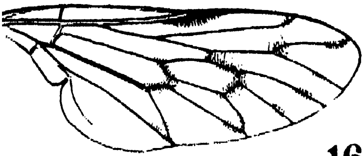

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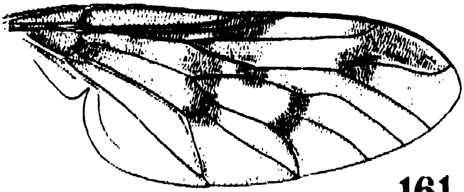

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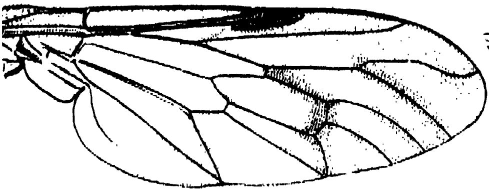

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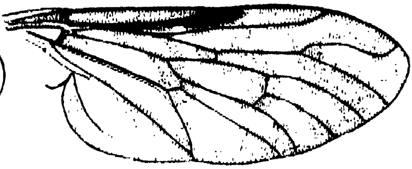

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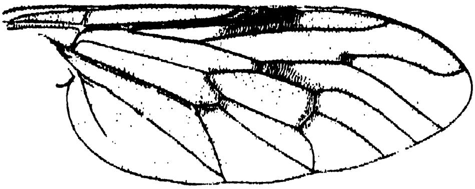

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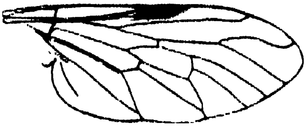

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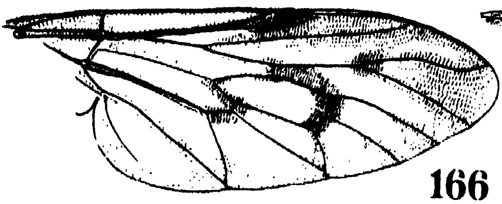

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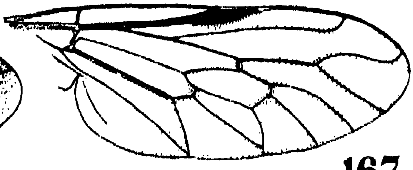

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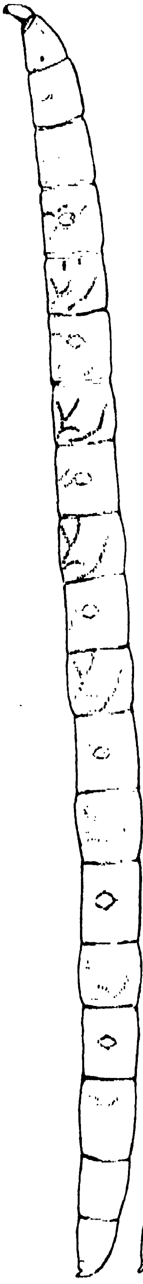
NORTH AMERICAN FLIES OF THE FAMILY THERIVIDAE.

FOR EXPLANATION OF PLATE SEE PAGE 138.



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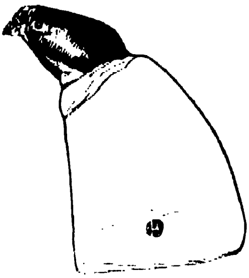

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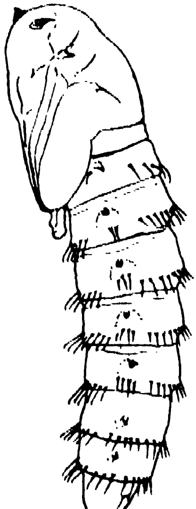

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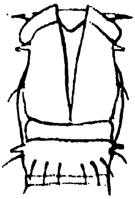

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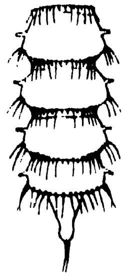

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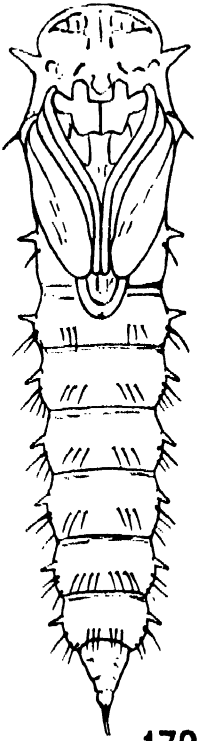

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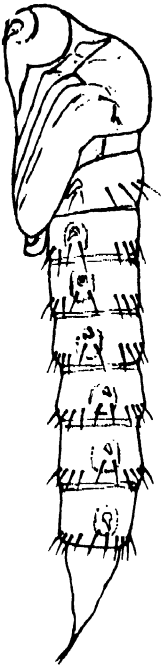

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North American Flies of the Family Therividae.

For explanation of plate see page 138.

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A NEW FOSSIL TURTLE, KINOSTERNON ARIZONENSE, FROM ARIZONA.

By Charles W. Gilmore,

Associate Curator, Division of Paleontology, United States National Museum.

INTRODUCTION.

In a collection of vertebrate fossils made by Dr. J. W. Gidley in the spring of 1921, near Benson, Cochise County, Arizona, were two well-preserved turtle specimens, the first extinct representative of the family Kinosternidae to be found in North America. It is also of interest that they are the male and female of a new species about to be described. Both specimens were found in the same deposit of fossils, within a few feet of one another, and associated with a considerable fauna consisting of mammal and bird remains.

Eight species of the genus *Kinosternon* are recognized in North America by Stejneger[1] and Barbour, of which only two, *Kinosternon sonoriense* LeConte and *K. flavescens* (Agassiz) are said to range into Arizona. It is the latter species to which the fossil form appears to be most nearly related.

I wish at this time to express my appreciation of the assistance given me by Dr. Leonhard Stejneger of the United States National Museum, especially in the comparison of the fossil with the extant species of Kinosternidae, a work that was made comparatively easy because of his intimate knowledge of the living species.

Family KINOSTERNIDAE.[2]

Nuchal plate produced into costiform processes, underlying the marginals. Plastral bones eight, the entoplastron being absent. Shell covered with epidermal shields. Caudal vertebrae procoelus. Neck completely retractile within the shell. Temporal region not roofed over; no parieto-squamosal arch. Digits moderately elongate; phalanges with condyles; claws four or five.

---

[1] A check List of North American Amphibians and Reptiles, Harvard University Press, 1917, pp. 111-112.

[2] The definition of the family and genus is that given by Dr. G. A. Boulenger in his Catalogue of the Chelonians, Rhynocephalians, and Crocodiles in the British Museum (new ed.), 1889, p. 33.

No. 2461—Proceedings U. S. National Museum, Vol. 62, Art. 5.

Genus KINOSTERNON Spix.

Carapace more or less depressed; marginal shields, one azygos nuchal and 11 pairs. Plastron articulating with the marginals by suture, front and hind lobe moveable; gular shield single or absent; pectoral shields not extending on the bridge. Postorbital and temporal arches moderate. Digits webbed; fingers all clawed, outer two clawless. Tail short.

KINOSTERNON ARIZONENSE, new species.

Plates 1 to 5.

Type.—Male. Cat. No. 10463, U.S.N.M.; consists of the nearly complete carapace and plastron, the latter lacking the anterior lobe; lower jaws, fragmentary vertebrae, limb bones, etc.

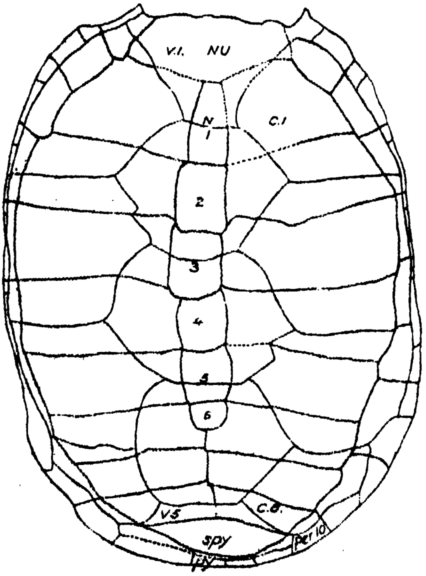

Fig. 1. Carapace of Kinosternon arizonense. No. 10463, U.S.N.M. Type. Male. C. 1, C. 8, costal bones 1 and 8; N, 1, 2, 3, 4, 5, 6, neural bones 1 to 6; Nu, nuchal bone; Per 10, tenth peripheral bone; Py, pygal bone; Spy, suprapygal bone; V1, V5, vertebral scutes 1 and 5. One-half natural size.

Paratype.—Female. Cat. No. 10462, U.S.N.M.; consists of the nearly complete carapace and plastron.

Type-locality.—Benson Locality Quarry, two miles south of Benson, Cochise County, Arizona.

Horizon.—Pliocene.

Collector.—J. W. Gidley, 1921.

When found the specimens were entirely disarticulated and broken into numerous pieces, and the assembling of these portions has resulted in some distortion and other imperfections in the carapace as may be observed in the illustrations (see pls. 1 and 3). Some small areas of both upper and lower shells were missing, although as a whole they are in a remarkably good state of preservation.

The much larger size of the fossil forms at once distinguishes them from any living species, and I therefore propose the name *Kinosternon arizonense* for their reception.

A comparison of the two specimens show them to be very similar, in the extent and arrangement of the various bony elements, as well as the epidermal shields which covered the osseous parts in life. That the larger specimen is a male appears to be shown by the concavity of the posterior lobe, the swelling outward of the lateral borders of this lobe back of the inguinal notch, and the fact that it fills this part of the carapace less completely than in the female, specimen No. 10462, U.S.N.M. (See pls. 2 and 4.) With the exception of the considerable difference in size of the two these are exactly the differences to be observed between the sexes of *K. flavescens*, as is shown by specimens Cat. Nos. 22671 and 19058, U.S.N.M.

While there are other characters, to be pointed out later, which indicate the affinities of *K. arizonense* to be nearest to *K. flavescens*, the sudden enlargement of the marginal scutes beginning with the ninth. see figs. 3 and 4, which arises well above the middle of the eighth peripheral, whereas the superior terminations of those anterior barely reach the middle and are usually below, are precisely the conditions found in *K. flavescens*, a character which Doctor Stejneger assures me is constant for that species, and one which serves to distinctly separate it from all other members of the genus.

In outline the carapace of *K. arizonense* is broadly oval, slightly excavated above the neck (see fig. 2), the hinder end evenly rounded with a slight median V-shaped notch. The length of the carapace of the paratype in a straight line is 148 millimeters. It is estimated that the carapace of the type which lacks some of the median anterior margin, would slightly exceed 170 millimeters in length. In width the type measures 118 millimeters; the paratype 108 millimeters; height at the center, type 73 millimeters, paratype 47.5 millimeters.

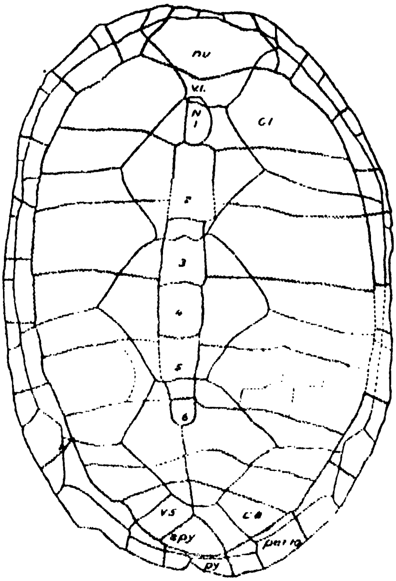

FIG. 2. CARAPACE OF KINOSTERNON ARIZONENSE. NO. 10462, U.S.N.M. PARATYPE. FEMALE. C. 1, C. 8, COSTAL BONES 1 AND 8; N, 1, 2, 3, 4, 5, 6, NEURAL BONES 1 TO 6; NU, NUCHALBONE; PER 10, TENTH PERIPHERAL BONE; PY, PYGAL BONE; SPY, SUPRAPYGAL BONE; V1, V5, VERTEBRAL SCUTES 1 TO 5. ONE-HALF NATURAL SIZE.

The surfaces of the shell are smooth, there being no indications of ridges or carinae, such as are found in some of the living species of the genus. The sulci are narrow and well impressed. The bone of both carapace and plastron is relatively thin. The free margins of the peripherals present a sharp edge, those posterior to the inguinal notch having a tendency to flare upward.

The paratype (pl. 3) shows the presence of a good sized nuchal slightly excavated for the neck on the free border, which measures 21 millimeters wide; the greatest width of this bone is 36 millimeters. It cannot be determined from the present specimens whether the nuchal was in contact with the first neural or whether these elements were separated by the intervention of the first costals meeting on the median line as in *Kinosternon leucostomum* as figured by Boulenger.[3]

In the type there are six neurals, all except the sixth being present. That a reduced sixth neural existed is clearly indicated by the excavated ends of the sixth pair of costals which unite on the median line posterior to the sixth neural, as shown in Figure 1. All except the sixth are longer than wide.

Measurements of neurals in millimeters.

No.	Length.		Width.	
	Type.	Paratype.	Type.	Paratype.
1	17.5	12.5	9	5.5
2	17.5	....	13	10
3	18	19	13	11
4	14.5	17	13	9.5
5	13.5	....	12	....
6	8	....	9	....

There are the usual eight costals of which the sixth, seventh, and eighth pairs meet on the median line. The single suprapygal in the type is large, having a greatest transverse diameter of 41 millimeters. The pygal is 26 millimeters wide and 18 millimeters long.

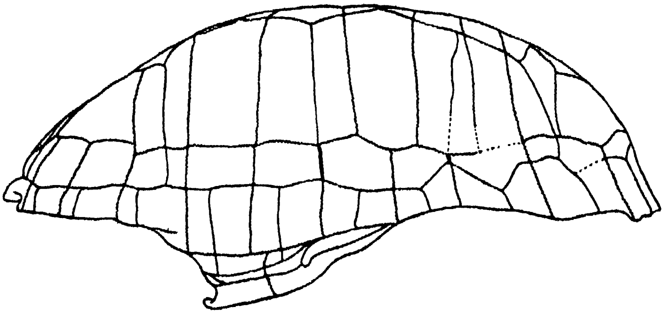

FIG. 3. CARAPACE OF KINOSTERNON ARIZONENSE. NO. 10463, U.S.N.M. TYPE MALE. VIEWED FROM THE LEFT SIDE. ONE-HALF NATURAL SIZE.

There are ten pairs of peripherals. The second in the type measures 22 millimeters from the free border to the union with the first costal plate; the fourth 20 millimeters; the seventh 24 millimeters; and the tenth 25.5 millimeters. The peripherals of the paratype, except for their smaller size, are identical in other respects. The fifth and sixth unite firmly by suture with the plastral bones as shown in Figure 7.

The paratype shows the nuchal scute to be very small. The vertebrals in both specimens are wider than long, being widely and acutely expanded at their centers.

---

[3] Catalogue of the Chelonians, Rhyncocephalians, and Crocodiles in the British Museum, 1889, fig. 12, pp. 35.

Measurements of vertebrals in millimeters.

No.	Length.		Width.	
	Type.	Paratype.	Type.	Paratype.
1	....	35	46	37
2	35	35	43	37
3	32.5	35	50	44
4	37	31.5	46	38
5	39	26	50	36

There are eleven pairs of marginal scutes as in the living species. The costo-marginal sulci, on the peripherals of the anterior half of the carapace, cross them well below the middle of their height, rising slightly on the median ones, but when the eighth is reached an abrupt increase in size of the marginals takes place as shown in Figures 3 and 4, as in the living *K. flavescens*.. The intermarginal sulci descend a little in front of the middle of the length of the peripherals.

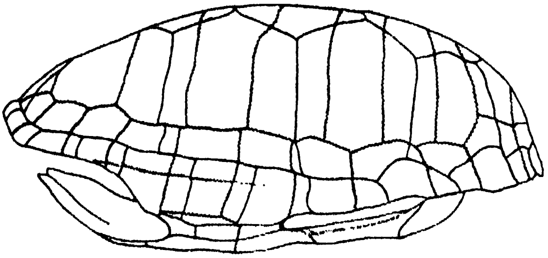

FIG. 4. CARAPACE OF KINOSTERNON ARIZONENSE. NO. 10462, U.S.N.M. PARATYPE. FEMALE. VIEWED FROM THE LEFT SIDE. ONE-HALF NATURAL SIZE.

In the type the front lobe of the plastron is missing, but in the paratype the plastron is almost perfectly preserved. The description to follow is based largely on that of the paratype. It is composed of eight bones the entoplastron being absent. The front lobes are hinged in both specimens, see Figures 5 and 6, the hinder ones being rigidly fixed. This species differs from *K. flavescens* in having a broadly V-shaped hinge line whereas in the living species it runs nearly straight across the plastron.

The greatest length of the plastron at the center is 117 millimeters, with a greatest transverse diameter of 92.5 millimeters. The anterior lobe is 41 millimeters long and 65 millimeters wide at the base. The width of this lobe grows gradually less for more than half its length, then rounds in rapidly toward the center which is slightly truncated. In *K. flavescens* this lobe narrows in more rapidly from the hinge forward, thus giving it a more pointed appearance.

The posterior lobe is 51 millimeters long and 57 millimeters wide at the base, whereas in the much larger type (male) specimen, the length of this lobe at the center is only 46.5 millimeters, and 53 millimeters wide at the base, but which expands posteriorly to 68 millimeters wide. It will thus be observed that the posterior lobe in the male is relatively much smaller than in the smaller female, compare Figures 5 and 6, a difference that prevails in the two sexes of the living *K. flavescens.* The posterior end is indented by a U-shaped notch, 7.5 millimeters deep and 10 millimeters wide in the male but only slightly indented in the female. The posterior extremities of the plastron end about 27 millimeters anterior to the posterior margin of the carapace. In the paratype this distance is only 18 millimeters. The bridge in the type has a width of 25 millimeters, but in the smaller paratype it measures 29 millimeters fore and aft. The plastron at the center of the bridge in the type measures 99 millimeters in width; the paratype 92 millimeters.

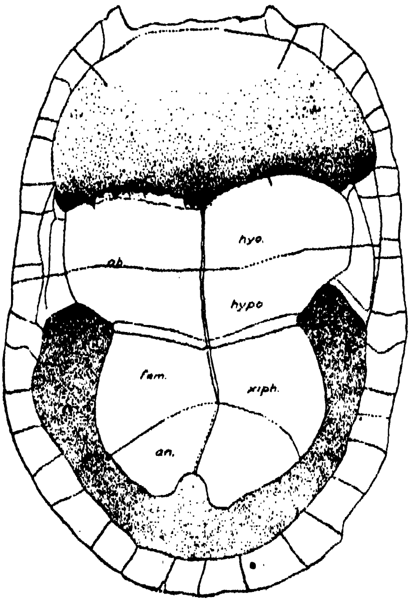

Fig. 5. Plastral view of carapace of Kinosternon arizonense. No. 10463, U.S.N.M. Type. Male. ab, abdominal scute; an, anal scute; fem, femoral scute; hyo, hyoplastral bone; hypo, hypoplastral bone; xiph, xiphiplastral bone. One-half natural size.

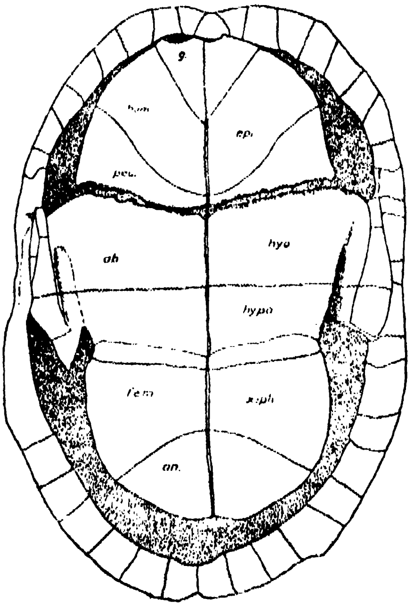

Fig. 6. Plastron of Kinosternon arizonense. No. 10462, U.S.N.M. Paratype. Female. ab, abdominal scute; an, anal scute; epi, epiplastral bone; hyo, hyoplastral bone; hypo, hypoplastral bone; xiph, xiphiplastral bones. More than one-half natural size.

The free borders of the plastra are acute on both front and hinder lobes, thickening slightly from the border inward, but nowhere does the plastron exceed 4 millimeters in thickness. The bevelled superior lateral borders on both front and back lobes are comparatively narrow as is well shown in Figure 7 and Plate 5.

Measurements of plastral bones and dermal scutes in millimeters.

	Type No. 10463, male.	Paratype No. 10462, female.
Length of epiplastral bone	....	40
Length of hyoplastral bone on median line	17	15
Length of hypoplastral bone on median line	22.5	19
Length of xiphiplastral bone on median line	35	41
DERMAL SCUTES.		
Length of gular scute on median line	....	20
Length of humeral scute on median line	....	18
Length of pectoral scute on median line	....	2
Length of abdominal scute on median line	36	32
Length of femoral scute on median line	18	17.5
Length of anal scute on median line	20	26

The single triangular gular scute extends posteriorly one-half the length of the anterior lobe, (see pl. 4), but in four specimens of *K. flavescens*, now before me, this scute only extends posteriorly one-third the length of the anterior lobe, because of this the humerals in the living species are correspondingly long on the median line. The paratype agrees with the extant species in having the pectorals meeting narrow on the median line. Boulenger,[4] however, in his definition of the species *flavescens* distinguishes it by having "pectoral suture nearly as long as that between humerals (in the adult)." Yet no specimens available to me in the National Museum collections show such a condition, all being short. *K. flavescens* also differs from the fossil species in having narrow femorals and pointed triangular anals. In *K. arizonense* these scutes at the center are of nearly equal length. On the bridge are two transversely narrow inframarginal scutes, the anterior one being very much smaller than the posterior. These scutes lie almost wholly on the plastral bones. (See figs. 5 and 6).

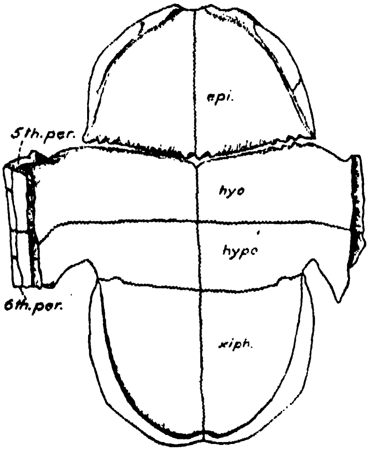

FIG. 7. PLASTRON OF KINOSTERNON ARIZONENSE. NO. 10462, U.S.N.M. PARATYPE. FEMALE. SUPERIOR VIEW. EPI, EPIPLASTRAL BONE; HYO, HYOPLASTRAL BONE; HYPO, HYPOPLASTRAL BONE; 5TH PER, 6TH PER, PERIPHERAL BONES 5 AND 6; XIPH, XIPHIPLASTRAL. ONE-HALF NATURAL SIZE.

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[4] Catalogue of the Chelonians, Rhynocephalians, and Crocodiles in the British Museum, 1889, p. 40.

Kinosternon arizonense apparently has its closest affinities with *K. flavescens* which now ranges into this same part of Arizona. It may be distinguished at once from that species by its much larger size; the more rounded anterior extension of the anal scutes, as contrasted with their longer and more pointed triangular shape in *K. flavescens*, which bring about a reduction of the femorals on the median line. Other differences might be pointed out such as the reduced number of neurals, broader anterior lobe, etc., but Doctor Stejneger, who has made an exhaustive study of the Kinosternidae, tells me that many of these features are so inconstant they cannot be relied upon for specific differentiation.

EXPLANATION OF PLATES.

Plate 1.

Carapace of *Kinosternon arizonense*. Cat. No. 10463, U.S.N.M. Type. Male. Superior view. About ¾ natural size.

Plate 2.

Plastron of *Kinosternon arizonense*. No. 10463, U.S.N.M. Type Male. Ventral view. About ¾ natural size.

Plate 3.

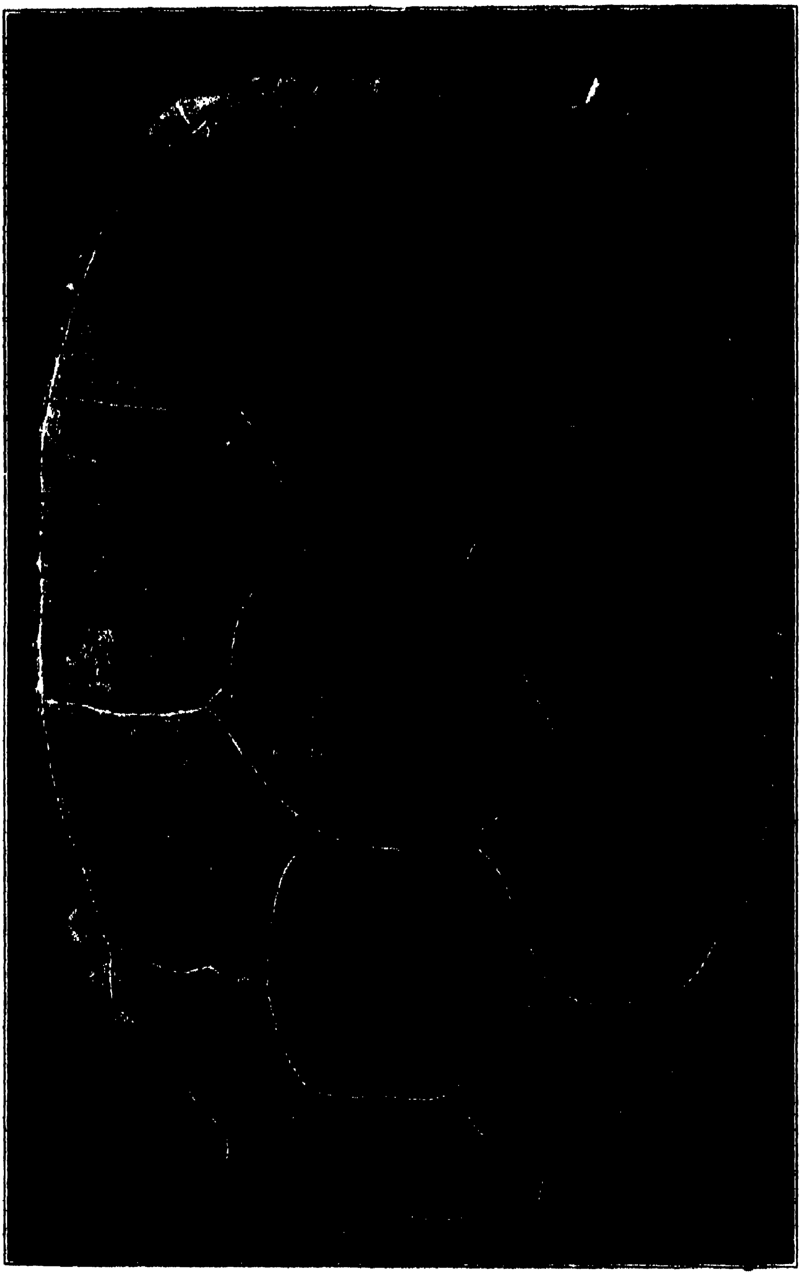
Carapace of *Kinosternon arizonense*. No. 10462, U.S.N.M. Paratype. Female. Superior view. About natural size.

Plate 4.

Plastron of *Kinosternon arizonense*. No. 10462, U.S.N.M. Paratype. Female. Ventral view. Natural size.

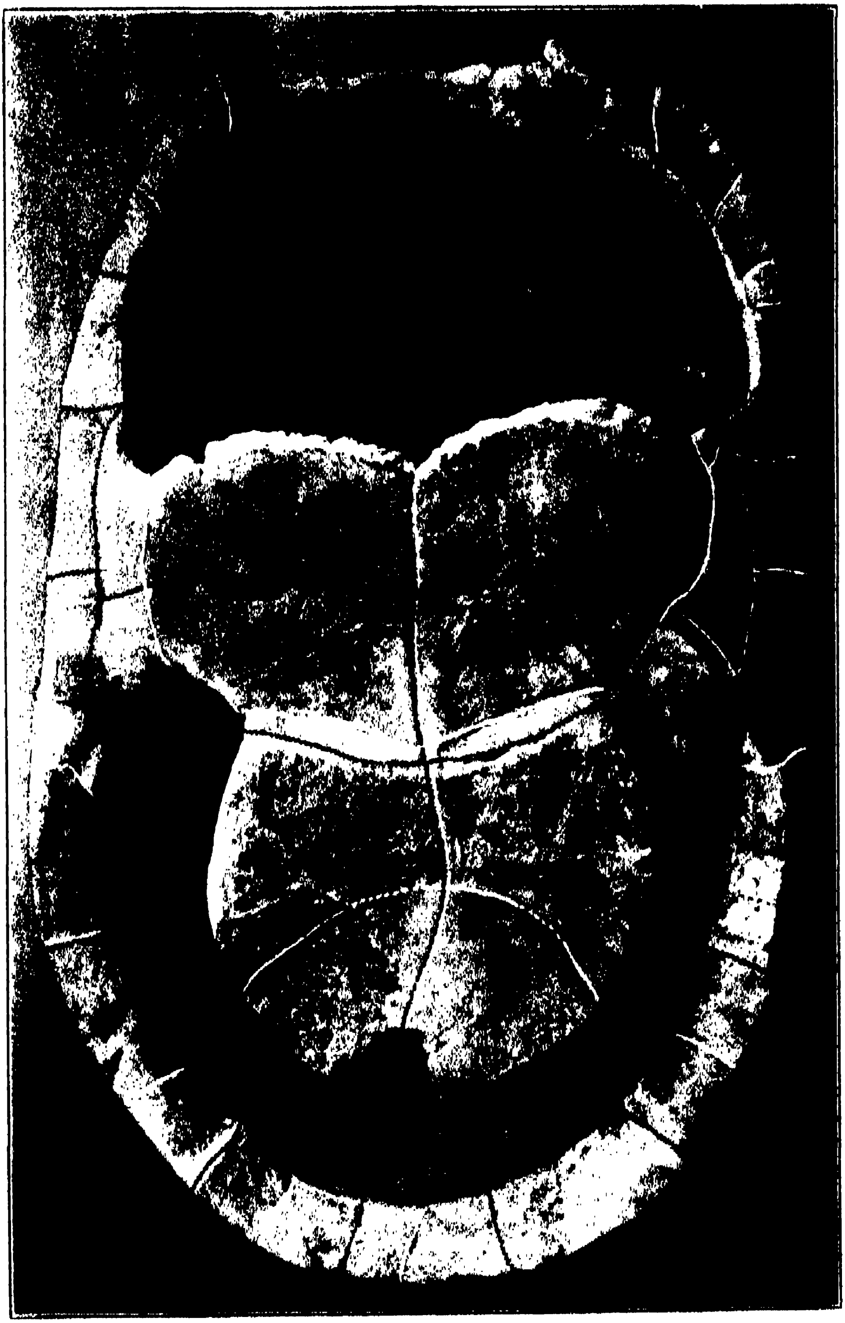
Plate 5.

Plastron of *Kinosternon arizonense*. No. 10462, U.S.N.M. Paratype. Superior view. Natural size.

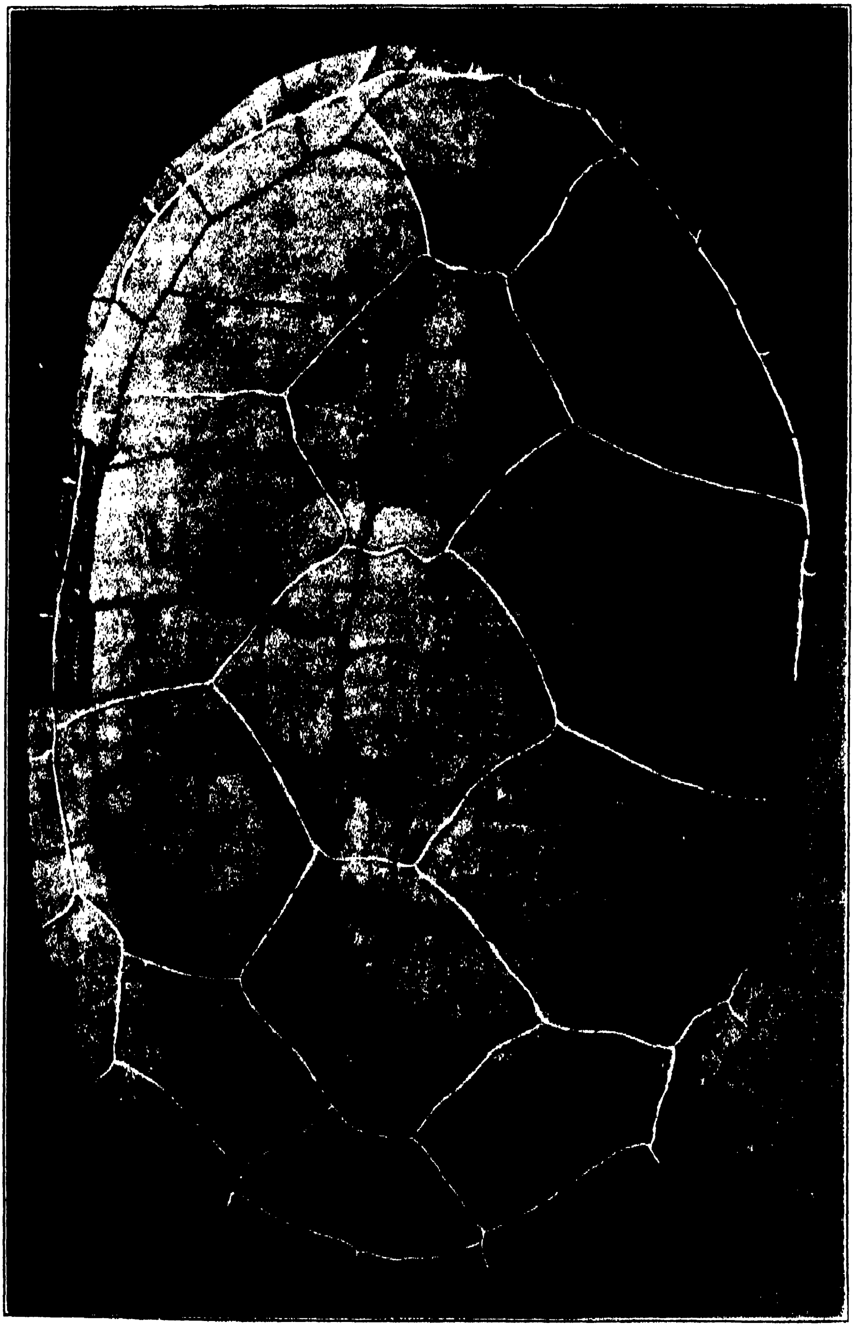


CARAPACE OF KINOSTERNON ARIZONENSE.

FOR EXPLANATION OF PLATE SEE PAGE 8

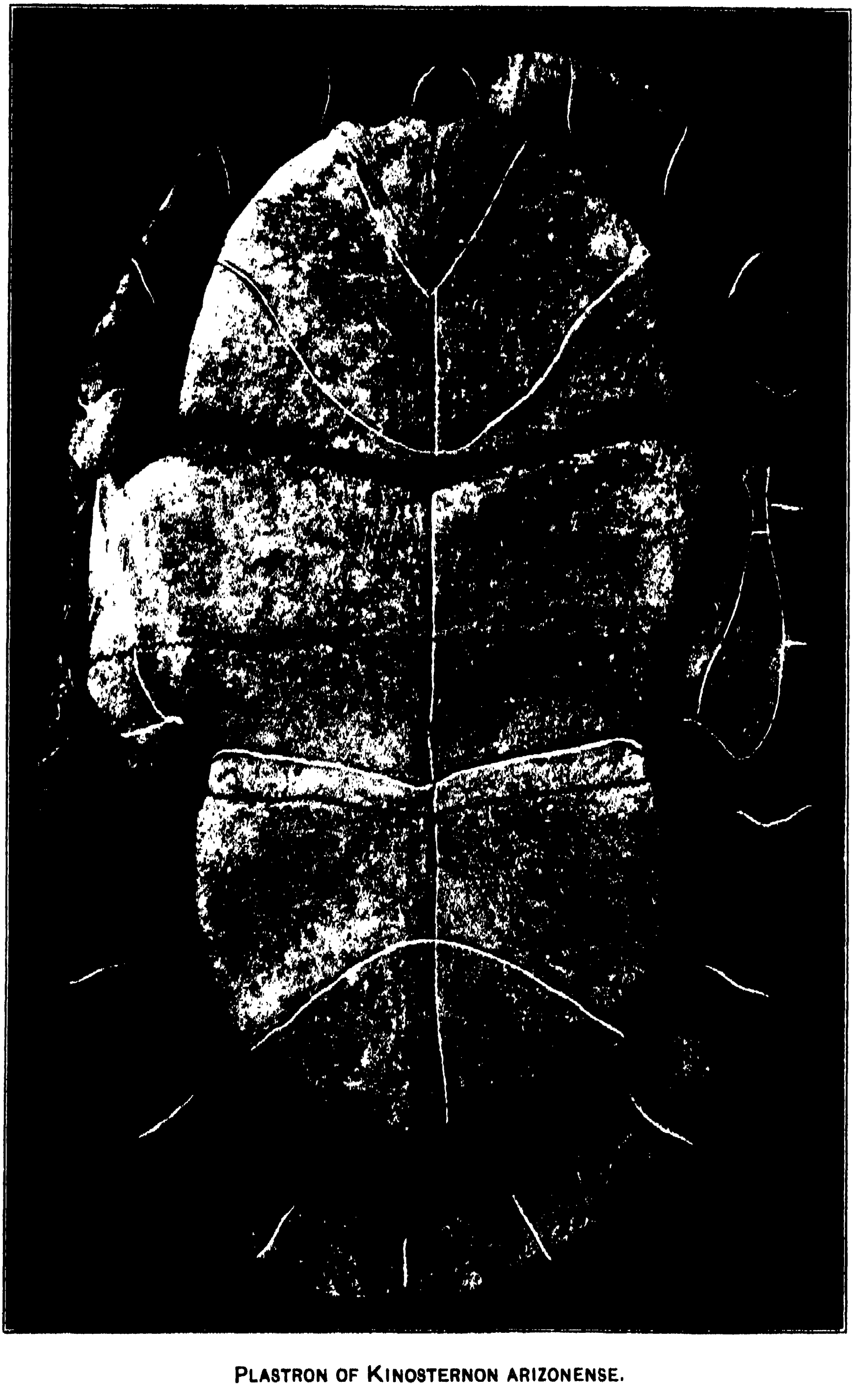


PLASTRON OF KINOSTERNON ARIZONENSE.

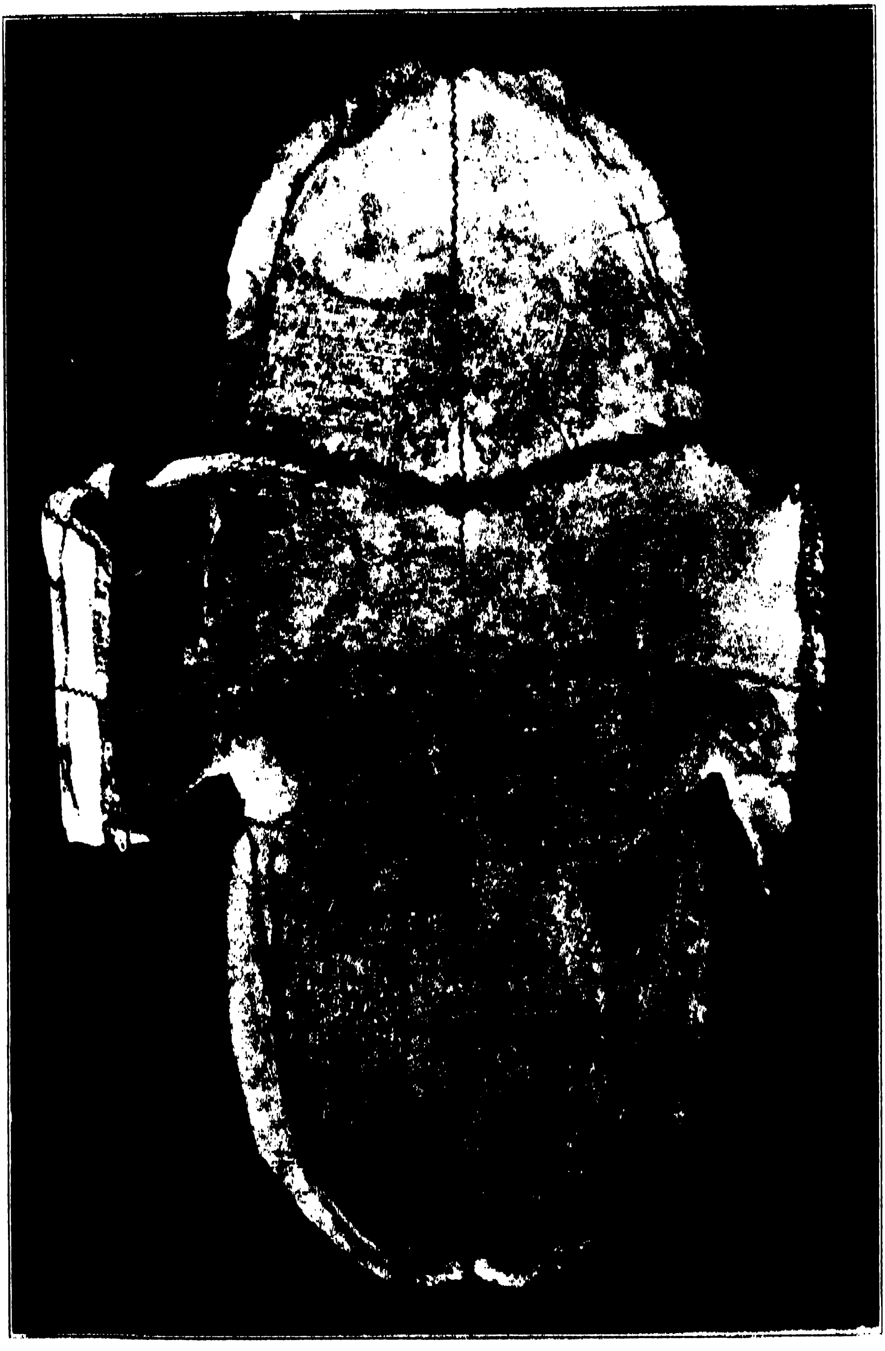


CARAPACE OF KINOSTERNON ARIZONENSE.

FOR EXPLANATION OF PLATE SEE PAGE 8.



PLASTRON OF KINOSTERNON ARIZONENSE.



PLASTRON OF KINOSTERNON ARIZONENSE.

REHABILITATION OF A HITHERTO OVERLOOKED SPECIES OF MUSK TURTLE OF THE SOUTHERN STATES.

By Leonhard Stejneger,
Head Curator of Biology, United States National Museum.

When Holbrook, in 1842, published his splendid five-volume edition of North American Herpetology with colored plates of all the species, he knew only one species of musk turtle, namely, the one Latreille in 1802 had given the name of *Testudo odorata* on account of its musky odor and which Holbrook figured and described as *Sternothaerus odoratus*. In 1856, however, J. E. Gray, in his Catalogue of Shield Reptiles in the British Museum, named the same genus *Aromochelys*, also with reference to the odor, adding at the same time a new species, *A. carinatus*, based on specimens from Louisiana. Louis Agassiz, at this very period, was writing his famous Contributions to the Natural History of the United States, but it was not until the first volume which contains the systematic treatment of the North American turtles was passing through the press that he received Gray's work, and found that his conclusions to some extent had been anticipated. In an appendix to the second volume (1857) he therefore synonymized his genera *Goniochelys* and *Ozotheca* (again a reference to the "Stinkpot," one of the favorite popular names of the musk turtle) with *Aromochelys*, and his new species *Goniochelys triquetra*, from Lake Concordia, Louisiana, with *A. carinatus*. But in addition he described two new species *Goniochelys minor* and *Ozotheca tristycha*, which, however, have not been generally accepted by herpetologists. Thus Cope, in 1875, and True, in 1883, completely ignored them. Boulenger, who did not recognize the musk turtles as a separate genus, but placed them in the genus *Kinosternon*, in his Catalogue of Chelonians in the British Museum (1883) placed *O. tristycha* in the synonymy of *Kinosternon odoratum*, and *G. minor* in that of *K. carinatum*, the latter, however, with a query. In this he was followed by Siebenrock, in his monograph of the family, 1907. The same disposition was made of these species in Stejneger and Barbour's Check List of North American Amphibians and Reptiles, published in 1917.

No. 2452.—Proceedings U. S. National Museum, Vol. 62, Art. 6.

During that year three full-grown specimens of a musk turtle were donated to the United States National Museum by Dr. O. P. Hay, who had collected them many years before near Vicksburg, Mississippi. It was recognized, though too late to be incorporated in the Check List, that they belonged to a species of which the National Museum then did not possess any specimens. Closer examination proved them to be true *Sternotherus carinatus*, and made it clear that all the other specimens so named, which we had from Georgia and Florida, were specifically different. Having now, through the courtesy of Dr. Thomas Barbour, been able to compare our material with Agassiz's cotypes in the Museum of Comparative Zoology, it is evident that the Georgia-Florida specimens are identical with his *Goniochelys minor* and represent a very distinct species which should now be known as *Sternotherus minor* (Agassiz).

The essential differences between *S. carinatus* and *S. minor* are: 1, the flat keelless sides of *S. carinatus*, which form a nearly straight slope from the sharp central keel to the marginals, while in *S. minor* this slope is much more arched, the convexity being usually emphasized by a sharp lateral keel on each side; and 2, the absence, or rarely vestigial presence, of a gular in *S. carinatus*, while in *S. minor* it is always distinct.

An examination of the published records of the specimens attributed to *S. carinatus* resulted in the discovery that nearly all belong to *S. minor* or to the supposed southern form of *S. odoratus* known as *tristychus*, and that *S. minor* occurs principally in Georgia, Alabama, and part of Florida. The reported occurence of *S. carinatus* in the eastern part of Tennessee[1] was therefore of particular interest, and, thanks to the courtesy of Dr. Henry Fowler, of the Philadelphia Academy Museum, I have had the opportunity of examining the specimen collected by Mr. Rhoads in the Emory River at Harriman, Roane County, Tennessee, a secondary affluent of the Tennessee River. It is unquestionably a young *S. minor* with three-keeled carapace and gular. From Mr. Rhoads's description of the specimen as having "two black bands pass back from the eye across and above tympanum and join on foreneck" it has been surmised that the specimen might rather belong to true *S. odoratus*, a striped head pattern being characteristic of the latter. But the irregularly curving dusky lines exhibited by Rhoads's specimen are entirely different from the dark transocular band, bordered above and below by a narrow well-defined yellow line, of *S. odoratus*. In fact, it is the yellow lines of the latter, not the dark lines, which are characteristic of the young *S. odoratus*, and of these there is no trace in the Emory River specimen.

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[1] Rhoads, Proc. Acad. Nat. Sci. Philadelphia, 1895, p. 384.

But what business has *S. minor* in the upper Tennessee River when it does not occur in the lower reaches of that river nor elsewhere in the Mississippi River drainage? Two articles in Science (vol. 12, new series, July 27, 1900) afford a very satisfactory answer to this question. The first one,[2] by Hayes and Campbell, gives a condensed account of their demonstration, based on purely physiographic evidence, that the Tennessee River some time in late Miocene was captured by the Mississippi drainage, and that before that time the upper Tennessee River flowed into the Alabama River system through the Coosa River. In the second article,[3] Mr. Charles T. Simpson showed that he had come to the identical conclusion on the basis of purely biologic evidence, namely the distribution of certain pearl mussels which are specifically identical in the two river systems.

It is then evident that at the time when the Tennessee River flowed directly southward from Chattanooga, and not toward the west as now, emptying into the Mississippi embayment far to the east of the mouth of the Mississippi River, the *S. minor* inhabited the upper drainage of eastern Alabama and western Georgia including the Appalachian Valley at least as far north as east central Tennessee.

We have thus not only a satisfactory explanation of the occurence of *S. minor* in the upper Tennessee, but the evidence is pretty conclusive that this species existed in its present form as early as the late Miocene, and that the genus *Sternotherus* consequently is much older. The contrary opinion, namely, that the Kinosternons are of very recent origin, because no fossil Kinosternid has been recorded, consequently falls to the ground and proves how dangerous it is to base any conclusions upon the negative fact of no paleontological record. Moreover, the lacking paleontological evidence has recently been furnished by the find of a fossil species of *Kinosternon* in Arizona, collected by Dr. J. W. Gidley and described and figured by Mr. C. W. Gilmore, both of the National Museum.[4]

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[2] The relation of biology to physiography, pp. 131–133.

[3] On the evidence of the Unionidae regarding the former courses of the Tennessee and other southern rivers, pp. 133–136.

[4] Proc. U. S. Nat. Mus., vol. 62, art. 5, 1923, pp. 1–8, pls. 1–5.

TWO NEW LITHOTHAMNIEAE, CALCAREOUS ALGAE, FROM THE LOWER MIOCENE OF TRINIDAD, BRITISH WEST INDIES.

By MARSHALL A. HOWE,
Of the New York Botanical Garden.

The following are descriptions of two species of fossil calcareous algae from Trinidad, submitted by T. W. Vaughan:

LITHOTHAMNIUM PENNYI, new species.

Plates 1 and 2.

Thallus forming irregular nodulose or verrucose concretions 3.5–5 cm. in diameter, the verrucae, knobs, or short branches up to 5 mm. high, 2–7 mm. broad, obtuse or subtruncate; transverse fractures of the knobs showing pronounced irregularly concentric, more or less plicate lamellae mostly 0.15–0.2 mm. thick; transverse or radio-vertical sections of the knobs conspicuously zonate by the frequent alternations of large-celled secondary hypothallia and small-celled perithallia; cells of medullary hypothallia irregular in outline and arrangement, mostly 25–50μ high by 13–25μ broad; cells of secondary hypothallia (or of large-celled perithallia?) 14–25μ high, 13–28μ broad, subquadrate, often broader than high, less commonly higher than broad, distinctly layered in the outer zones, less distinctly in the inner; cells of the perithallia minute, subquadrate, 4–7μ high or broad, rather indistinctly layered; conceptacles (tetrasporic) becoming embedded, the cavity 350–600μ in maximum width, 150–200μ in height, the roof usually well defined.

A single, nearly free specimen in Matchepoorie quarry, longitude 61° 14′ 35″ W.; latitude 10° 27′ 25″ N., Trinidad, British West Indies, F. W. Penny No. 5, station No. 8301 (lower Miocene).

Type in U. S. National Museum, Cat. No. 36604.

Of the hitherto described American fossil Lithothamnieae, *Lithothamnium pennyi* is apparently most nearly allied to *L. vaughanii* M. A. Howe[1] from the Oligocene of the Panama Canal Zone, but differs in having a thallus the surface of which is knobbed or verrucose rather than developing anastomosed branches, in the larger cells of the large-celled zones, the smaller cells of the small-celled zones, and the consequently more pronounced zonation, and in the somewhat smaller tetrasporic conceptacles. The conceptacles sometimes show small pores in the roof with sufficient clearness to leave no doubt that the type specimen is a tetrasporic plant of the genus *Lithothamnium*.

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[1] U. S. Nat. Mus. Bull. 103, 1919, p. 6, pl. 7, figs. 1 and 2, and pl. 8.

LITHOPHYLLUM TRINITENSE, new species.

Plates 3 and 4.

Thallus crustaceous, 0.75–2 mm. thick, becoming superposed, massive, and 0.5–3.5 cm. thick, the surface nearly smooth, undulate-rugose, or broadly and irregularly submammillate, delaminating; vertical fractures showing undulate-plicate zonations 1 mm. or less broad; hypothallia usually inconspicuous the cells 15–26µ×10–13µ, not distinctly "coaxial" or layered; perithallium rather distinctly or somewhat obscurely zonate, its cells 9–18 (24)µ high and 8–13µ broad, usually higher than broad, or subquadrate, in very distinct layers; conceptacles 320–450µ in diameter, becoming embedded.

A single specimen, more or less embedded, associated with corals (?) and occasionally intercalated with *Lithoporella melobesioides* (Foslie) Foslie, and forming the greater part of a mass that is 9 cm. long, 5 cm. broad, and 4 cm. thick, in Gasparillo quarry, Trinidad, British West Indies, F. W. Penny, No. G 5, station No. 8297 (lower Miocene).

Type in U. S. National Museum, Cat. No. 36605.

Of the hitherto described American fossil Lithothamnieae, *Lithophyllum trinitense* is perhaps best comparable with *L. homogeneum* M. A. Howe[1] from the upper Eocene or lower Oligocene of St. Bartholomew, British West Indies, but the thallus appears to strictly crustaceous, showing at most only low elevations in place of the well-developed branch system of *L. homogeneum* and in a thin ground section the general structure is seen to be more zonate and less homogeneous and the cells of the hypothallium less distinctly "coaxial" or layered. Conceptacles were not found in *L. homogeneum*.

EXPLANATION OF PLATES.

PLATE 1.

Lithothamnium pennyi M. A. Howe.

FIGS. 1 and 2. Photographs showing opposite sides, in lengthwise view, of the single type specimen, from Matchepoorie quarry, Trinidad, F. W. Penny, No. 5, station 8901, natural size.

3. Photograph of a transverse or slightly oblique section through one of the knobs of the above specimen, enlarged 42 diameters.

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[1] Carnegie Inst. Washington Publ. no. 291, 1919, p. 14, pl. 1, fig. 1 and pl. 3.

PLATE 2.

Lithothamnium pennyi M. A. Howe.

Photograph of a part of a transverse section, through one of the knobs, enlarged 100 diameters.

PLATE 3.

Lithophyllum trinitense M. A. Howe.

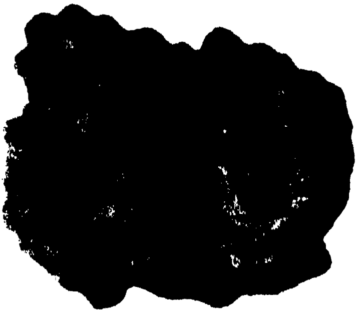
FIG. 1. Photograph of the single type specimen, natural size, showing the superposed laminations of the *Lithophyllum*, seen especially well in the median zone. Above the center, a little at the left, are the remains of a very different organism (coral?). Gasparillo quarry, Trinidad, F. W. Penny, No. G. 5, station 8297.

2. Photograph of a vertical section, showing one lamina, its hypothallium, conceptacles, etc., enlarged 42 diameters.

PLATE 4.

Lithophyllum trinitense M. A. Howe.

Photograph of a vertical section, showing zonations, perithallia, conceptacles, etc., enlarged 100 diameters.



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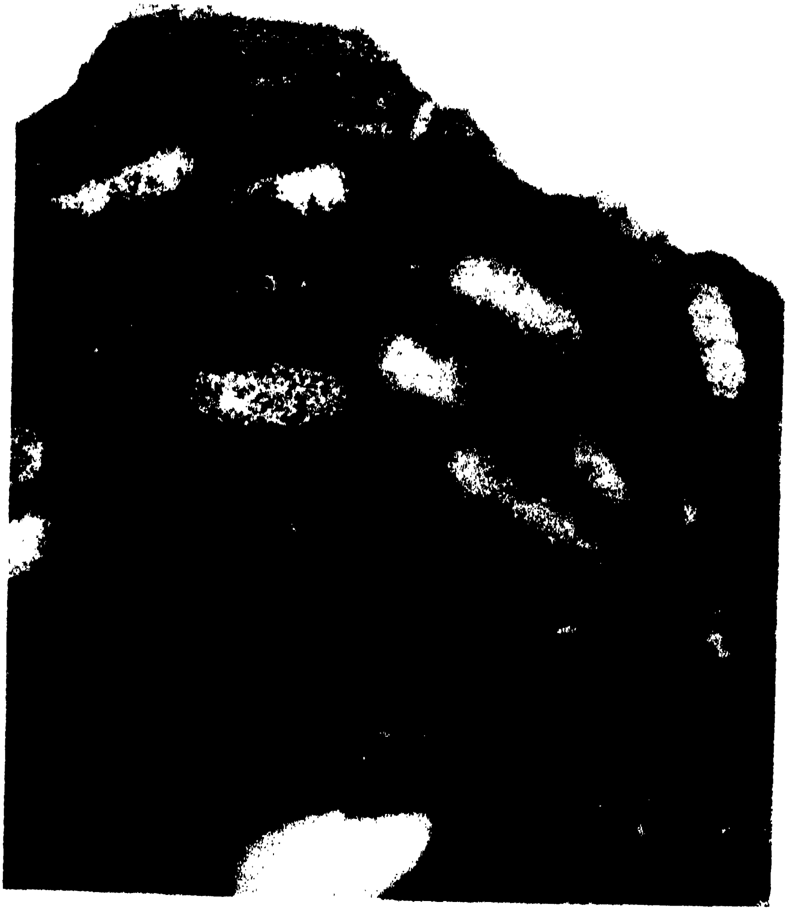


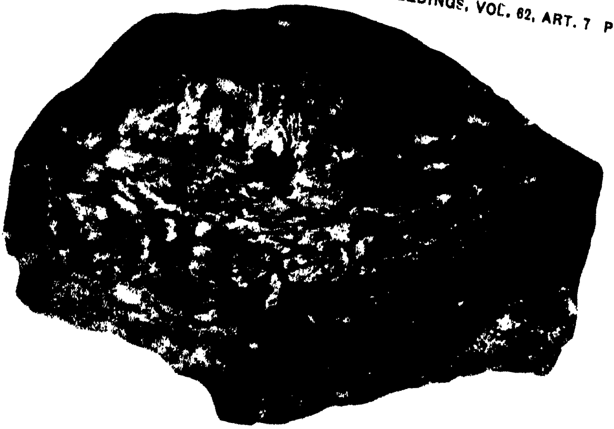
3

LITHOTHAMNIUM PENNYI M. A. HOWE.

FOR EXPLANATION OF PLATE SEE PAGE 2.

LITHOTHAMNIUM PENNYI M. A. HOWE.

FOR EXPLANATION OF PLATE SEE PAGE 3



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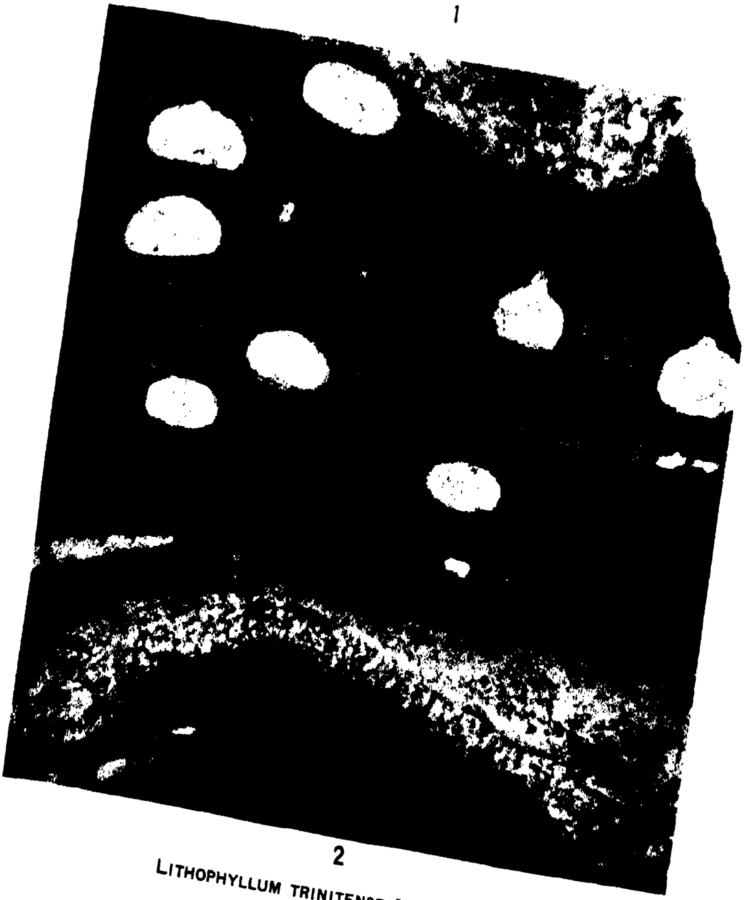

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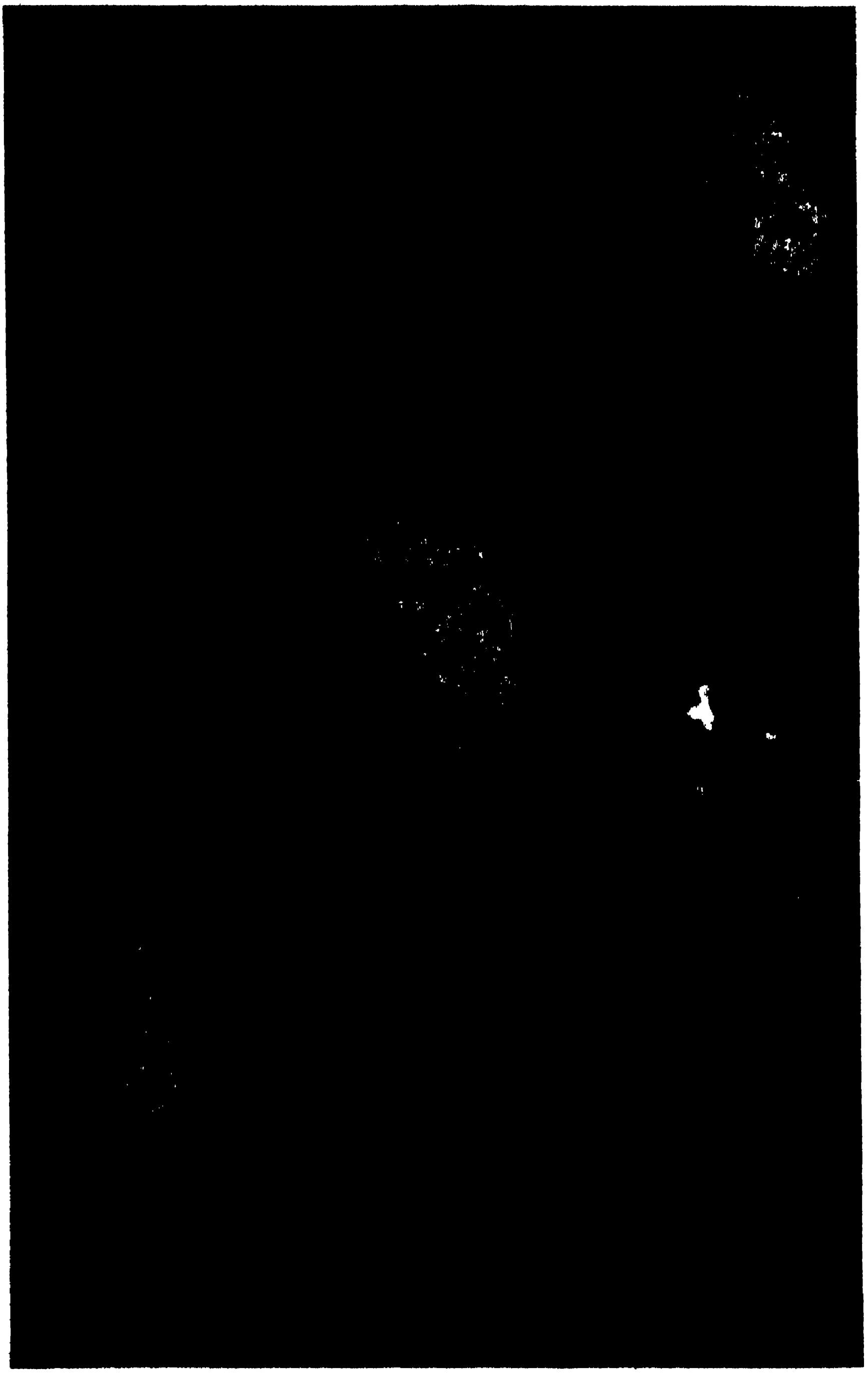
LITHOPHYLLUM TRINITENSE M. A. HOWE.



LITHOPHYLLUM TRINITENSE M. A. HOWE.

THE LEAF AND TWIG MINING BUPRESTID BEETLES OF MEXICO AND CENTRAL AMERICA.

By WARREN S. FISHER,

Of the Bureau of Entomology, United States Department of Agriculture.

This paper is the result of a study of the Buprestid beetles of the Tribes Agrilini (Group Trachytes) and Mastogenini from Mexico and Central America, in the collection of the United States National Museum. In 1910 the Smithsonian Institution organized a Biological Survey for the study of the fauna of the Panama Canal Zone, which was made during the winter of 1910–11. The greater part of the material recorded in the present paper has been collected by Messrs. E. A. Schwarz and August Busck, who were detailed by the Bureau of Entomology to make a study of the insect fauna in connection with the survey.

The present paper includes all of the described species of these two groups from Mexico and Central America, with the exception of a few species which are unknown to the writer, and which have the descriptions so incomplete as to make it impossible to correlate the characters given in the original descriptons with those used in the keys. One genus and 42 species are described as new, and the types of all these new species are in the National Museum. Quite a number of the old species are not represented in the National Museum Collection, but to make the paper more complete these have been included in the keys solely upon the characters given in the original descriptons, and also their distribution, so far as known from the literature. The keys are not intended to show the taxonomic relation of the species, but simply to assist in their identification. It has been impossible to show the true relationship of the species at the present time, on account of not having sufficient material available for study, but it is hoped that it will stimulate the collecting of these small interesting beetles, which can be taken by sweeping the flowers and foliage of miscellaneous plants.

Nine genera and 111 species have been previously described in these groups from Mexico and Central America, and the number is increased to 10 genera and 153 species in the present paper.

The writer will be glad to identify material in these groups at any time.

Tribe AGRILINI.

Group TRACHYTES Lacordaire.

Trachydes LACORDAIRE, Gen. Col., vol. 4, 1857, p. 86.

This group of the tribe Agrilini, besides the genera given in the following key, also includes the following genera: *Cylindromorphoides* Kerremans, *Anthaxomorphus* H. Deyrolle, *Germarica* Blackburn, *Aphanisticus* Latreille, *Endelus* H. Deyrolle, *Paratrachys* Saunders, *Stenianthe* Fairmaire, *Pseudianthe* Fairmaire, *Sponsorinus* Fairmaire, and *Janthe* Marseul, none of which are found in the Western Hemisphere except the genus *Cylindromorphoides*, which was erected for a slender species from Brazil. The species of this group are distinct from all the other *Agrilini* in having the median coxae more widely separated than the anterior ones, anterior margin of the posterior coxae only slightly concave, and the tarsi very short.

In this group the body is usually broad and ovate, sometimes, however, elongate and slender; in both cases they are usually narrowed behind. The front of head is strongly narrowed by the insertion of the antennae, which have the poriferous fossae terminal; antennal cavities large and situated a certain distance from the eyes; base of pronotum sinuate at the sides, with a median lobe; scutellum triangular and sometimes very small; prosternum very variable in form; sternal cavity for the insertion of the prosternal process formed entirely in the metasternum, the mesosternum being widely divided; middle coxae more widely separated than the anterior ones; hind coxal plate but slightly dilated internally, narrowest at the middle, and broader externally, with the anterior margin only slightly concave; tarsi very short; tarsal claws toothed or appendiculate.

The larvae, so far as known, are miners in the leaves of various plants, although very little is know about the biology of the species found in the tropical parts of the world. The adults are found feeding on the leaves of a great variety of plants, and are quite active during the warmer part of the day.

KEY TO THE GENERA.

1. Antennae lodged in a distinct deep groove in the prosternum.............. 2
   Antennae free in repose, not lodged in a groove in the prosternum.
   Trachys Fabricius.
2. Legs lodged in depressions beneath.. 3
   Legs free... 5

3. Tibiae flattened, outer margin sharp .... **Pachyschelus** Solier.
   Tibiae cylindrical or subcylindrical, outer margin not sharp 4
4. Prosternal process deeply longitudinally grooved .... **Brachys** Solier.
   Prosternal process not longitudinally grooved .... **Lius** H. Deyrolle.
5. Prosternal process strongly constricted by the anterior coxal cavities; agriliform. **Taphrocerus** Solier.
   Prosternal process not constricted by the anterior coxal cavities; form oblong or ovate 6
6. Metasternum deeply and narrowly arcuately emarginate; prosternal process narrow, and narrowly rounded at apex; body subcylindrical, strongly convex beneath .... **Callimicra** H. Deyrolle.
   Metasternum broadly arcuately emarginate; prosternal process usually very broad, and broadly rounded at apex (in a few species it is rather narrow, and narrowly rounded at apex); body elliptical or oval, flattened or feebly convex beneath.. 7
7. Antennae abruptly dentate from the sixth joint, outer joints triangular. **Leiopleura** H. Deyrolle.
   Antennae compact, gradually broader anteriorly, outer joints nearly square. **Leiopleurella** Fisher.

The genera *Leiopleura* and *Callimicra* are very closely allied and some of the species have a tendency toward connecting the two genera. In the genus *Leiopleura* the species usually have the prosternal process very broad, broadly rounded at the apex, and the body strongly flattened beneath, but there are a few oblong species which approach the genus *Callimicra* by having the body more convex beneath, the prosternal process narrower, and more narrowly rounded at the apex, in which case the anterior margin of the metasternum is more deeply emarginate. In *Callimicra* the body is usually more subcylindrical, but in a few species it is more flattened and thus approaches the genus *Leiopleura*. In all of the species examined in this genus the prosternal process was narrow, and narrowly rounded at the apex, with the anterior margin of the metasterum deeply emarginate for the reception of the prosternal process.

In nearly all of the species the legs are lodged, more or less, in depressions on the underside of the body, but this character as used in the key applies only to the species which have the depressions very deep, and the upper surface of the legs, when in repose, is nearly on the same level as the remainder of the body.

Genus TRACHYS Fabricius.

Trachys FABRICIUS, Syst. Eleuth., vol. 2, 1801, p. 218.

This is a very large genus and contains about 350 described species. It is distributed throughout the entire world, with the exception of the Nearctic Region, which includes Canada, United States, and the northern half of Mexico. The species of this genus reach their highest development in the Indo-Malaysian Region, and so far only

7 species are known from America, 2 of which are described below. Besides the species mentioned in the key, the following have been described from South America: *estebana* Kerremans, from Venezuela; *chevrolati* Kerremans, from Guadeloupe Island; *boliviana* Kerremans, from Bolivia; and *amazonica* Kerremans, from the Amazon region of Brazil.

KEY TO THE SPECIES.

1. Above bicolored; head and pronotum piceus; elytra cyaneous.
cyanipennis Fisher.
Above unicolored.. 2
2. Above green, with a cyaneous tinge; front of head broadly depressed.
concinna Fisher.
Above aeneous; front of head not broadly depressed.... **segregatus** Waterhouse.

TRACHYS SEGREGATUS Waterhouse.

Trachys segregatus WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 131.

This bronzy species was described by Waterhouse from Guatemala, and was the first species of this genus to be described from the Western Hemisphere. It is said to be allied to the European *Trachys troglodytes* Schoenherr, from which it differs in being smaller and relatively narrower, elytra longer and more gradually narrowed to apex; head narrower without median groove; pronotum not quite as short, sides more distinctly margined, posterior angles less diverging, and the punctures smaller and very close together; elytra with humeral callus more distinct and glabrous, punctures smaller and moderately close together; and beneath with a few large, shallow punctures occupying the greater part of the surface. This species is not represented in the United States National Museum Collection, and is placed in the key from the characters given in the original description.

TRACHYS CYANIPENNIS, new species.

Elongate, rather strongly convex, broadly rounded in front, attenuate posteriorly, and slightly narrower behind than in front, glabrous and moderately shining; head, pronotum, and scutellum piceous, with a slight greenish reflection; elytra cyaneous, with a slight violaceous tinge; beneath piceous.

Head nearly flat, broadly and obsoletely depression on the front, the depression becoming obsolete on the occiput, and with a deep oblong depression behind the antennal cavities; surface irregularly and rather densely punctate, the punctures rather coarse on the occiput, but becoming obsolete anteriorly; intervals smooth; epistoma wide between the antennal cavities, the anterior margin deeply, arcuately emarginate; antennae rather short, with the first two joints bluish-black, and remainder of joints piceous. Pronotum slightly convex, nearly three times as wide as long, distinctly narrower in front than behind, widest at the base; sides feebly arcuately attenuate from base to anterior angles, and narrowly margined; anterior angles rather acute; posterior angles rectangular; anterior margin broadly arcuately emarginate, with an obsolete lobe at middle; base transversely truncate to near middle of the elytron, then feebly sinuate and turning obliquely backward to the scutellum, in front of which it is truncate; surface without depressions, rather densely and irregularly punctate, the punctures rather shallow and well separated; intervals smooth. Scutellum very small, smooth, and triangular. Elytra moderately convex, slightly wider than pronotum at base; humeral angles obtusely angulated; sides parallel to the middle, then arcuately attenuate to the tips, which are conjointly narrowly rounded, with the lateral margins entire; each elytron with a broad, very shallow depression at the base, and a deep, elongate one behind the humerus along the lateral margin; surface without lateral carina, densely and coarsely punctate, the punctures deep and confluent at the base, but becoming finer and more widely separated toward the apex; intervals smooth. Abdomen beneath rather densely marked with shallow ocellate punctures, which are denser on the first segment and somewhat confluent at the sides; intervals obsoletely reticulate-striolate; last segment broadly rounded at apex. Prosternum sparsely and coarsely punctured; anterior margin broadly rounded; prosternal process rather narrow, slightly expanded behind the coxal cavities, and broadly rounded at apex.

Length, 2.5 mm.; width, 1.25 mm.

Type locality.—Porto Bello, Panama.

Type.—Cat. No. 25092, U.S.N.M.

Described from a single specimen collected by August Busck, March 3, 1911.

TRACHYS CONCINNA, new species.

Elongate, moderately convex, broadly rounded in front, attenuate posteriorly, and slightly narrower behind than in front, glabrous and strongly shining; head and pronotum green, the former strongly aeneous on the front; elytra green with a strong cyaneous tinge; beneath piceous.

Head nearly flat, rather deeply and broadly depressed on the front, with a rather deep round depression behind the antennal cavities; surface irregularly and coarsely punctate, the punctures widely separated, and becoming finer toward the epistoma; intervals smooth; epistoma wide between the antennae, the anterior margin deeply, arcuately emarginate; antennae rather short and entirely piceous. Pronotum slightly convex, two and one-half times as wide as long, distinctly narrower in front than behind, widest at the base; sides obliquely attenuate from base to anterior angles, and narrowly margined; anterior angles rather acute; posterior angles rectangular;

anterior margin broadly arcuately emarginate, with an obsolete lobe at middle; base transversely truncate to near middle of the elytron, then feebly sinuate and turning obliquely backward to the scutellum, in front of which it is narrowly rounded; surface with a broad, shallow depression near the posterior angles, irregularly and coarsely punctured, similar to that of the head; intervals smooth. Scutellum obsolete, punctiform. Elytra moderately convex, slightly wider than pronotum at base; humeral angles broadly rounded; sides parallel to behind the middle (rather strongly sinuate at basal third), then arcuately attenuate to the tips, which are conjointly narrowly rounded, with the lateral margins entire; each elytron with a broad, rather deep depression at the base, and a similar one behind the humerus, close to the lateral margin; surface without lateral carina, rather densely and irregularly punctate, the punctures very coarse at the base, becoming obsolete at the apex, and with a tendency of forming striae on the disk, between which is a series of smaller punctures; intervals smooth. Abdomen beneath coarsely and rather sparsely punctate, the punctures shallow and open on the one side, and becoming striolate at the sides of the first segment; intervals finely and densely reticulate-striolate; last segment broadly rounded at apex. Prosternum coarsely and sparsely punctured; anterior margin broadly rounded; prosternal process broad, slightly expanded behind the coxal cavities, and broadly rounded at apex.

Length, 3.25 mm.; width, 1.75 mm.

Type locality.—Turrialba, Costa Rica.

Type.—Cat. No. 25093, U.S.N.M.

Described from a single specimen collected by Messrs. Schild and Burgdorf.

In dissecting a number of specimens of various species in this genus, I find that it is the females that have the apical part of the abdomen armed with a series of small teeth, and not the males, as recorded by Waterhouse. Since he has used this character in the description of the males of his new species, the sexes should be reversed in all his descriptions in this genus. The males in this genus have the last abdominal segment entire, and sometimes produced into a short, acute spine at the apex.

Genus PACHYSCHELUS Solier.

Pachyschelus SOLIER, Ann. Soc. Ent. France, ser. 1, vol. 2, 1833, p. 318.

This is a very large genus and contains about 164 species, 16 of which are described as new in the present paper. This genus has a rather wide distribution, and reaches its highest development in South America, from where the type species of the genus was described. Of this large number of species, 7 have been described from the Indo-Malaysian Region, 2 from Madagascar, 1 from Africa, 5 from the United States, 62 from Mexico and Central America, and the remainder from South America.

Pachyschelus cyaneus (Gory), described from Brazil[1] and recorded by Waterhouse,[2] from Teapa, Mexico; San Juan and El Tumador, Guatemala; Taboga Island, Panama; and Cayenne, Guiana, and also *Pachyschelus robustus* described by Waterhouse from San Geronimo, Guatemala,[3] have been omitted from the key, as it has been impossible to correlate the characters given in the original descriptions with those used in the key.

Mr. Waterhouse states[4] "that the structure of the apex of the abdomen of the males appears to afford good specific characters, and finds that the arrangement and form of the teeth are constant." Throughout the genus he uses this character in describing the males, and on plate 8 figures the terminal part of the abdomen of the males of 24 species. Nicolay and Weiss in their paper on The Genera Pachyschelus and Taphrocerus[5] have followed Waterhouse in the use of this sexual character as applied to the males.

KEY TO THE SPECIES.

1. Elytra distinctly pubescent, or with pubescent spots 2
Elytra glabrous, or with only a few obsolete hairs arising from the punctures .. 29
2. Broadly ovate species 3
Oblong species 8
3. Regularly oval 4
Not regularly oval, more acuminate posteriorly 6
4. Elytra cupreous or aeneous, with a purplish or greenish tinge, rather densely pubescent, with a small dark lunate spot on disk, and a less distinct, broadly arcuate one at apical third .... **rotundipennis** Fisher.
Elytra black 5
5. Elytra with a violaceous or bluish-green tinge, and sparsely pubescent, the pubescence arranged in irregular longitudinal rows .... **atroviridis** Fisher.
Elytra densely clothed with cinereous pubescence, except a large lunate spot (common to both elytron), where the pubescence is black .. **lunifer** Waterhouse.
6. Surface above bicolored; head and pronotum aureous; elytra violaceous, and very sparsely, irregularly pubescent .... **festivus** Fisher.
Surface above unicolored 7
7. Elytra black, with a slight coppery-purple tinge along sides, shining and clothed with cinereous pubescence, except for a large round spot, common to both elytron .... **cinctus** Waterhouse.
Elytra black, with lateral margins narrowly violaceous, subopaque, and rather densely clothed with cinereous pubescence, the pubescence forming irregular designs .... **pilosus** Fisher.
8. Elytra attenuate from base to apex 9
Elytra with sides parallel to basal third, or slightly wider at middle of elytra than at base, then attenuate to the apex 15

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[1] Mon. Bupr. Suppl., vol. 4, 1841, p. 344, pl. 58, fig. 340.
[2] Biol. Centr.-Amer., Coleopt., vol. 3, pt. 1, 1889, p. 145.
[3] Idem, pp. 142-143.
[4] Idem, p. 137.
[5] Journ. N. Y. Ent. Soc., vol. 28, 1920, pp. 137-142.

9. Regularly oblong; sides of elytra arcuately attenuate from base to apex...... 10

Trapeziformis or subtrapeziformis; sides of elytra obliquely attenuate from base to apex.. 11

10. Above aeneous, with a slight brownish tinge on the elytra; sparsely pubescent, the pubescence not forming any distinct designs ...... irroratus Waterhouse.

Above black, with a violet-carmine reflection; elytra sparsely clothed with isolated whitish hairs .... carmineus Kerremans.

11. Surface above aeneous or cupreous, with a brownish tinge................. 12

Surface above piceous.. 13

12. Elytron with the sutural angles distinctly produced ..trapezoidalis Waterhouse.

Elytron with the sutural angles not produced........... signatus Waterhouse.

13. Surface above piceous, with a strong violaceous tinge 14

Surface above piceous, without any violaceous tinge.... albopictus Kerremans.

14. Elytra with the apex subtruncate; surface densely punctured, and somewhat opaque... mexicanus Fisher.

Elytra with the apex broadly rounded; surface sparsely punctured and shining. jenningsi Fisher.

15. Surface above bicolored.. 16

Surface above unicolored... 21

16. Pronotum aeneous... 17

Pronotum black, bluish-green, or coppery-brown............................ 18

17. Elytra violaceous, with one transverse pubescent fascia.. pubicollis Waterhouse.

Elytra violaceous, with two transverse pubescent fasciae... cuneiformis Fisher.

18. Pronotum coppery-brown; elytra purplish, with a distinct pubescent fascia behind middle, which appears almost to cover the apex; form nearly as narrow in front as behind.................................. laticeps Waterhouse.

Pronotum black or bluish-green... 19

19. Pronotum bluish-green; elytra dark blue, with violet or purplish tints at base and sides, and with two undulating pubescent fasciae, one behind the middle and the other near the apex........................... bifasciatus Waterhouse.

Pronotum black... 20

20. Elytra purplish, very sparsely pubescent, the pubescence arising from the punctures and arranged in longitudinal rows; pronotum black, with the lateral margins greenish................................purpureipennis Waterhouse.

Elytra dark blue, the cinereous pubescence forming small patches on the middle of disk near the apex; pronotum entirely black.......... bicolor Kerremans.

21. Sides of elytra slightly wider at middle than base, dark cupreous, with a purplish tinge, with a little whitish pubescence near scutellum, a small spot near the suture about the middle, and a distinct curved fascia, commencing at the margin behind the middle, and descending to the apical third at the suture. elegans Waterhouse.

Sides of elytra parallel to near the middle.. 22

22. Surface above piceous.. 23

Surface above blue, green, or aeneous 24

23. Elytra deeply depressed at base; surface strongly violaceous, and ornated with cinereous pubescence as follows: An irregular area behind scutellum, a transverse undulating fascia at middle, and a narrow undulating one at the apical fourth... albofasciatus Fisher.

Elytra not deeply depressed at base; surface feebly bluish or violaceous, and ornated with cinereous pubescence as follows: A narrow transverse fascia at middle, and a narrow undulating one at the apical third.... atrifrons Fisher.

24. Surface above blue or green.. 25

Surface above dark aeneous; each elytron ornated with yellowish pubescence as follows: An elongate area behind the scutellum, a narrow fascia extending from the humerus obliquely backward toward the suture, a transverse undulating fascia at middle, a similar one just behind the middle, and an obsolete transverse one at the apex.............................. **sulcifrons** Fisher.

25. Surface above bottle green; elytra with a narrow transverse fascia of cinereous pubescence at apical third........................... **unifasciatus** Fisher.
Surface above blue... 26

26. Elytra with only one pubescent fascia..................................... 27
Elytra with more than one pubescent fascia............................... 28

27. Each elytron with a narrow, slightly oblique fascia of white pubescence at apical fourth, reaching from the lateral margin to near the suture; female with last abdominal segment armed with four short triangular teeth, arranged in a curve on each side of a moderately wide triangular notch.... **biguttatus** Waterhouse.
Each elytron with a slightly wider oblique fascia at apical fourth, which is more distant from the suture than in *biguttatus;* last abdominal segment of female broad at apex, only slightly curved, and with eight subequal teeth, the middle pair a little more separated than the others............ **sticticus** Waterhouse.

28. Each elytron with a white spot close to the scutellum, a fascia commencing at the lateral angulation descends slightly to about the middle of the elytron, then ascends obliquely, and, turning over, descends to the suture; and a distinct anteapical fascia, which is transverse at sides, then ascends obliquely a very short distance, then descends to the suture...... **undulatus** Waterhouse.
Each elytron with an oblique pubescent fascia at apical fourth, reaching from the lateral margin to near the suture, and with a few white spots on the disk at middle.. **azureus** Waterhouse.

29. Broadly ovate species.. 30
Oblong species... 40

30. Regularly ovate.. 31
Not regularly ovate, more acuminate posteriorly........................... 38

31. Surface above unicolored 32
Surface above bicolored... 34

32. Strongly convex above; surface above entirely black and shining.
hydroporoides Waterhouse.
Moderately convex above; surface above subopaque; head and pronotum densely punctured; elytra more rugose, and closely strigose near the base......... 33

33. Surface above dark green, with very short obsolete hairs; scutellum with a feeble piceous tinge.................................... **obsoletepilosus** Fisher.
Surface above brunneo-aeneous....................... **centralis** Waterhouse.

34. Strongly convex above.. 35
Moderately convex above.. 36

35. Pronotum bluish-green; elytra blue...................... **ovalis** Waterhouse.
Pronotum cupreous, with a golden tinge; elytra bluish-green, with the base tinted purple.. **astraeus** Waterhouse.

36. Pronotum cupreous; elytra coppery-red, with a broad bluish-purple margin.
discoidalis Waterhouse.
Pronotum bluish-black, sometimes with the margins tinted purple......... 37

37. Elytra dark blue, with a slight purplish tinge at margins; pronotum densely punctured.. **modestus** Waterhouse.
Elytra purplish-blue, more strongly depressed above; pronotum sparsely punctured... **aversus** Waterhouse.

38. Scutellum two times as wide as long, anterior angles rectangular; surface above subopaque.. **subopacus** Fisher.
Scutellum not two times as wide as long, anterior angles acute; surface above shining... 39

39. Sides of elytra angulated at middle; pronotum piceous, with the sides narrowly margined with dull green; elytra violaceous........ **nigricollis** Waterhouse.

Sides of elytra not angulated at middle; color very variable.
compactus Waterhouse.

40. Above strongly depressed.. 41

Above moderately convex.. 42

41. Head and pronotum pale green; scutellum piceous; elytra violaceous; beneath piceous; female with last abdominal segment strongly produced at apex, with a deep V-shaped incision at middle, and with one broad and three very sharp teeth on each side.................................... **chapuisi** (Dugès).

Head, pronotum, and scutellum pale green; elytra caeruleus; beneath dark green; female with last abdominal segment not strongly produced, slightly arcuate at apex, with eight teeth, the outer tooth at each end of the series is acute and the apex pointed outwards, the other six teeth are broad and nearly truncate.. **deplanatus** (Chevrolat).

42. Elytra arcuately attenuate from base to apex.. 43

Elytra not arcuately attenuate from base to apex.. 44

43. Surface above uniformly piceous, with a feeble violaceous reflection.
unicolor Fisher.

Surface above bicolored; head and pronotum golden-green, the latter with the median part cupreous; elytra cyaneous or purplish..... **ardens** Waterhouse.

44. Elytra a little wider at basal fourth than at base.. 45

Elytra with sides parallel to apical third, and rather strongly angulated near middle.. 55

45. Surface above uniformly cyaneous........................ **affinis** Waterhouse.

Surface above bicolored.. 46

46. Elytra bicolored.. 47

Elytra unicolored.. 48

47. Elytra coppery-red, with the disk fuscous......... **granulosicollis** Waterhouse.

Elytra cyaneous, with the apical third bright coppery-red, the coppery area margined anteriorly with a strong violaceous color........ **cupricauda** Fisher.

48. Pronotum unicolored.. 49

Pronotum bicolored.. 52

49. Pronotum golden-green or aeneous.. 50

Pronotum uniformly black with an aeneous tinge.. 51

50. Pronotum golden-green; elytra coppery-red.............. **fulgens** Waterhouse.

Pronotum aeneous; elytra dark bluish-green............. **constans** Waterhouse.

51. Elytra purple; female with the last abdominal segment narrowly rounded at apex, with a deep V-shaped incision at middle, and four nearly equidistant teeth on each side, arranged in a curve, the central pair is a little larger (not longer) than the outer ones..................... **purpureipennis** Waterhouse.

Elytra piceous, with a strong bluish-green and violaceous tinge; female with the last abdominal segment narrow and strongly produced at apex, deeply, narrowly, and arcuately emarginate at middle, with a very strong tooth on each side of it, next to which is a shorter tooth, and on the outside, a very small acute tooth at a lower level................ **panamensis** female Fisher.

52. Elytra cyaneous.. 53

Elytra piceous, with a strong bluish-green and violaceous tinge; pronotum piceous, with the sides aeneous................. **panamensis** male Fisher.

53. Disk of pronotum black or fuscous.. 54

Disk of pronotum golden-green, with the sides cyaneous; elytra cyaneous; last abdominal segment of female with a small triangular notch in middle, a broad, angularly emarginate process on each side, and a small acute tooth on the outside at a lower level........................... **dubius** Waterhouse.

54. Pronotum with the sides dark green..... **cyanellus** male (Castelnau and Gory).
Pronotum with the sides pale bluish-green............. **diversus** Waterhouse.
55. Pronotum unicolored.. 56
Pronotum bicolored.. 57
56. Pronotum black; elytra dark green.................. **solitarius** Kerremans.
Pronotum coppery-red or aeneous; elytra cyaneous... **thoracicus** Waterhouse.
57. Disk of pronotum cyaneous, with an aeneous tinge, sides cupreo-aureis; elytra purple.. **incertus** Waterhouse.
Disk of pronotum black or fuscous; sides aeneous or greenish.............. 58
58. Elytra violaceous or purplish; last abdominal segment of female arcuately emarginate at middle, with three very short teeth placed obliquely on each side, the outer tooth rather smaller than the others........ **familiaris** Waterhouse.
Elytra cyaneous.. 59
59. Front of head when viewed from above arcuately rounded; last abdominal segment of female with three nearly equal acute teeth placed obliquely on each side; the two sets of teeth separated by a rather wide arcuate emargination.. **communis** Waterhouse.
Front of head when viewed from above feebly emarginate................. 60
60. Pronotum with the sides broadly margined with a bright aeneous color, the black area extending over one-third of the surface; female with the last abdominal segment narrow at apex; and with eight acute equidistant teeth arranged in a curve, the central pair being a little smaller than the outer ones.. **octodentatus** Waterhouse.
Pronotum with the sides narrowly margined with an aeneous or greenish color, the black area extending over more than one-third of the surface; last abdominal segment of female produced and truncate at apex, with a slight notch in the middle, and with two very small teeth close together at the outer angle of the truncature.. **secedens** Waterhouse.

PACHYSCHELUS ROTUNDIPENNIS, new species.

Male.—Broadly ovate, slightly longer than wide, broadly rounded in front, slightly narrower behind than in front, moderately shining; head and lateral margins of pronotum auro-cupreous; disk of pronotum, scutellum, and elytra dark cupreous; surface rather densely clothed with short recumbent cinereous hairs, and with a dark lunate area on disk of elytra; beneath piceous.

Head flat and deeply embedded in the prothorax, with an obsolete median depression on the front; surface shining and densely punctate, the punctures large and well separated, densely clothed over entire surface with rather long, recumbent, cinereous hairs; intervals finely, densely granulated anteriorly, becoming smoother on the occiput. Pronotum moderately convex, about four times as wide as long at middle, distinctly narrower in front than behind, widest at the basal third; sides arcuate from base to basal third, then strongly, obliquely arcuate to the anterior angles, which are broadly rounded; anterior margin deeply, arcuately emarginate for the insertion of the head; base feebly obliquely truncate to the elytral lobe, where it is acutely, arcuately emarginate, then transversely truncate in front of scutellum; hind angles obtuse, not projecting beyond the humeral angles of the elytra; surface broadly, obsoletely depressed toward the sides, densely punctate, the punctures large, very shallow and open on one side, becoming finer on the disk, densely clothed over entire surface with rather long, recumbent, cinereous hairs; intervals finely and densely granulated at the sides, the granulation becoming more obsolete on the disk. Scutellum smooth and glabrous, with the anterior angles acute. Elytra as wide as pronotum at base, widest at basal fourth; humeral angles obtuse; sides broadly rounded to middle, then arcuately attenuate to the tips, which are conjointly broadly rounded, the lateral margin being entire and when viewed from the side is broadly and deeply arcuate at the middle; surface with a broad, shallow depression at the base, a deeper one extending from the humeral angle obliquely backward to the middle, and connected to a narrow depression along the lateral margin extending to near the tip, causing a round gibbosity behind the middle, which is slightly closer to the lateral margin than to the suture, finely, densely punctate over entire surface, and rather densely clothed with short, recumbent, cinereous hairs, except a small lunate spot a short distance behind the scutellum (common to both elytron), where the pubescence is black; there is also an obsolete dark area extending obliquelv backward from the humeri, and a broadly arcuate one at the apical third, caused by the cinereous pubescence being sparser and allowing the surface color to become more prominent. Abdomen beneath flat, sparsely and coarsely punctate, the punctures shallow and open on the one side, from each puncture arising a rather long, recumbent, cinereous hair; intervals finely and densely reticulate; last segment very broadly rounded at apex. Elytral epipleura broad and rather deeply concave. Metasternum more coarsely punctured than abdomen, and truncate in front. Prosternum short, very deeply emarginated for the insertion of the head; prosternal process rather narrow, about two times as wide as the coxal cavities, sides nearly parallel, and the apex broadly rounded; prothoracic episternum parallel, long, very narrow, and deeply concave. Prothoracic epipleura very wide, and moderately concave; antennal grooves deep, nearly transverse, and reaching to the lateral margin slightly in front of the middle; lateral margin acute.

Female.—Differs from the male in having the head and pronotum entirely dark cupreous, and the last abdominal segment very broadly rounded, almost truncate, with the angles broadly rounded, and furnished with about 26 short, blunt teeth, one or two at the extremities of the series being smaller and not so well defined as the others, the portion in front of the marginal groove with a row of large teeth at the tip, and a transverse series of very long yellowish hairs at middle of segment.

Length, 3.2 mm.; width, 3 mm.

Type locality.—Paraiso, Canal Zone, Panama.

Type, allotype, and *paratypes.*—Cat. No. 25094, U.S.N.M.

Described from six specimens, three males and three females, all collected at Paraiso, Canal Zone, Panama, by August Busck and E. A. Schwarz during February, March, and April, 1911. The elytra of three of the paratypes are of a greenish-bronze color instead of dark cupreous as in the type; otherwise they are identical.

This is a very rotund species, and superficially resembles some of the Coccinellidae. It is closely allied to *lunifer* Waterhouse, described from Guatemala, but is of a cupreous or greenish-bronze color above, and with a dark arcuate area near the apex. The terminal segment of the abdomen of the female is quite different from *lunifer*, but resembles more closely that of *laticeps*, described by Waterhouse from Panama, although differing in other respects from that species.

PACHYSCHELUS ATROVIRIDIS, new species.

Male.—Broadly ovate, slightly longer than wide, slightly narrower behind than in front, shining, black, with a violaceous and bluish-green tinge; surface sparsely pubescent; beneath piceous.

Head flat and rather deeply embedded in the prothorax, with an obsolete median depression on the occiput; surface rather densely, coarsely punctate and densely, obsoletely granulated. Pronotum moderately convex, about three times as wide as long at middle, much narrower in front than behind, widest at base; sides strongly obliquely arcuate from base to apical angles, which are nearly rectangular; anterior margin broadly, arcuately emarginate; base feebly, obliquely truncate to the elytral lobe, where it is acutely, arcuately emarginate, then transversely truncate in front of scutellum; hind angles nearly rectangular, not projecting beyond the humeral angles of the elytra and fitting closely to them; surface feebly depressed near the posterior angles, sides densely, finley granulated and sparsely punctate, the punctures large, shallow, and open on one side, becoming obsolete on the disk, very sparsely clothed with short, inconspicuous cinereous hairs. Scutellum obsoletely granulated, and glabrous, with the anterior angles acutely rounded. Elytra as wide as pronotum at base, widest at the middle; humeral angles obtuse; sides broadly arcuate, more attenuate posteriorly to the tips, which are rather broadly, conjointly rounded, the lateral margin entire, and when viewed from the side is broadly arcuate from humeral angle to the apex; each elytron with a rather broad, shallow depression at the base, and a deeper one between the humerus and lateral margin, extending along margin from the humeral angle to the middle; surface sparsely and rather coarsely punctate, sparsely clothed with irregular patches of recumbent cinereous pubescence, which is arranged longitudinally, and each elytron with a broader, conspicuous spot at the middle a short distance from the suture. Abdomen beneath slightly convex, sparsely and obsoletely punctate, the punctures very shallow and usually open on the one side, clothed with a few inconspicuous recumbent hairs; intervals very finely and obsoletely reticulate; last segment rather acutely rounded at apex. Elytral epipleura narrow. Metasternum more coarsely punctured than the abdomen, and rather deeply, arcuately emarginate in front. Prosternum rather broadly emarginate in front; prosternal process rather narrow, a little more than two times as wide as the coxal cavities, sides nearly parallel, and the apex broadly rounded; prothoracic episternum nearly parallel, long, very narrow, and nearly flat. Prothoracic epipleura wide and nearly flat, except for a shallow longitudinal depression behind the antennal groove; lateral margin nearly rectangular; antennal groove deep and extending to the lateral margin near the middle, and parallel to the tibial groove.

Length, 2.5 mm.; width, 1.8 mm.

Type locality.—Lion Hill, Canal Zone, Panama.

Type.—Cat. No. 25095, U.S.N.M.

Described from a unique male collected by August Busck, June 18, 1907.

This is a short ovate species allied to *cinctus* Waterhouse, but can be distinguished from that species by being sparsely pubescent, and the pubescence on elytra arranged longitudinally.

PACHYSCHELUS LUNIFER Waterhouse.

Pachyschelus lunifer WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, pp. 148–149, pl. 7, figs. 22, 22*a*.

This species was described from material collected by Mr. Champion, at Volcan de Atitlan, Guatemala, at an altitude of 3,000 feet. The type is in the British Museum and has not been examined. The species is placed in the key from the characters given in the original description.

PACHYSCHELUS FESTIVUS, new species.

Male.—Broadly ovate, slightly longer than wide, more strongly narrowed behind than in front, shining; head and pronotum bright aureous; scutellum and elytra cyaneous, becoming violaceous toward the margins; surface sparsely pubescent; beneath piceous.

Head flat, feebly longitudinally and rather broadly grooved from vertex to epistoma; surface shining, with a few large, shallow, distant punctures, and very sparsely clothed with obsolete cinereous hairs. Pronotum moderately convex, three and one-half times as wide as long at middle, much narrower in front than behind, widest at base; sides strongly, obliquely arcuate from base to apical angles, which are nearly rectangular; anterior margin broadly, arcuately emarginate; base obliquely truncate to the elytral lobe, where it is rather broadly arcuately emarginate, then transversely truncate in front of scutellum; hind angles obtuse, not projecting beyond the humeral angles of the elytra and fitting closely to them; surface broadly, obsoletely depressed toward the sides, and with two small round depressions on the disk, sides sparsely punctate, the punctures large and very shallow, becoming nearly obsolete on the disk, very sparsely clothed with short inconspicuous cinereous hairs. Scutellum obsoletely granulated and glabrous, with the anterior angles rather broadly rounded. Elytra as wide as pronotum at base, widest at basal fourth; humeral angles obtuse; sides broadly arcuate, more attenuate posteriorly to the tips, which are conjointly rounded, the lateral margin entire, and when viewed from the side, is broadly arcuate from humeral angle to the apex; each elytron with a rather broad, shallow depression at the base, and a deeper one between the humerus and lateral margin, extending along the margin from the humeral angle to middle, and becoming broader behind the humerus; surface rather densely, coarsely punctate and sparsely clothed with recumbent cinereous pubescence, forming an indistinct transverse fascia at middle and sparsely covering the apical fourth. Abdomen beneath slightly convex, sparsely and obsoletely punctate, the punctures very shallow and usually open on the one side, sparsely clothed with inconspicuous recumbent hairs; intervals finely and obsoletely reticulate; last segment rather acutely rounded at apex. Elytral epipleura narrow. Metasternum more coarsely punctured than the abdomen, and rather deeply arcuately emarginate in front. Prosternum nearly truncate in front; prosternal process rather narrow, a little more than two times as wide as the coxal cavities, sides slightly expanded behind the coxal cavities, with the apex broadly rounded; episternum nearly parallel, long, very narrow, and slightly concave. Prothoracic epipleura wide and nearly flat, except for a shallow longitudinal groove behind the antennal groove; lateral margin nearly rectangular; antennal groove very deep and extending to the lateral margin near the middle, and parallel to the tibial groove.

Length, 2.4 mm.; width, 1.7 mm.

Type locality.—Panama City, Panama.

Type.—Cat. No. 25096, U.S.N.M.

Described from a unique male collected by A. H. Jennings, April 12, 1911.

In form and color this species resembles the variety of *compactus* Waterhouse with the cupreous head and pronotum, but it is more robust than that species, and also differs from it in being sparsely pubescent, the pubescence forming indistinct transverse fascia on the elytra.

PACHYSCHELUS CINCTUS Wa

Pachyschelus cinctus WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 149, pl. 8, fig. 15.

This species was described from material collected by Mr. Champion, at Rio Maria Linda, Guatemala, at an elevation of 500 feet, and also from Volcan de Chiriqui, Panama, at an altitude of 2,000 to 4,000 feet, without designating any definite type locality. No specimens of this species have been examined, and it is placed in the key solely upon the characters given in the original description.

PACHYSCHELUS PILOSUS, new species.

Female.—Broadly ovate, slightly longer than wide, more strongly narrowed behind than in front, subopaque, piceous, with the elytra narrowly violaceous along lateral margins; surface rather densely pubescent, the pubescence forming irregular designs on the elytra; beneath piceous, more shining than above.

Head flat and deeply embedded in the prothorax, with an obsolete median depression on the vertex: surface rather densely punctate, the punctures large, shallow, and well separated, sparsely clothed with rather short cinereous hairs on the occiput; intervals finely, densely granulated. Pronotum moderately convex, nearly four times as wide as long at the middle, much narrower in front than behind, widest at base; sides strongly, obliquely arcuate from base to apical angles, and narrowly margined; apical angles nearly rectangular; anterior margin deeply, arcuately emarginate for the insertion of the head; base feebly, obliquely truncate to the elytral lobe, where it is acutely, arcuately emarginate, then transversely truncate in front of scutellum; hind angles obtuse, not projecting beyond the humeral angles of the elytra and fitting closely to them; surface feebly depressed at base, finely, densely granulated over entire surface, sparsely clothed with short, recumbent black and cinereous pubescence forming irregular designs. Scutellum obsoletely punctured, and glabrous, with the anterior angles acute. Elytra as wide as pronotum at base; widest at basal fourth; humeral angles obtuse; sides broadly arcuate, rather strongly attenuate posteriorly to the tips, which are conjointly rounded, the lateral margin very feebly serrate, and when viewed from the side, is broadly arcuate from humeral angle to apex and feebly sinuate just behind the middle; each elytron with a broad, shallow depression at the base, and a deeper one between the humerus and lateral margin, extending along the margin from the humeral angle to the middle, and becoming much broader and deeper behind the humerus; surface finely, densely punctate, becoming somewhat rugose toward the sides, and sparsely, irregularly clothed with rather short recumbent cinereous and black pubescence, the black pubescence an each elytron forming an obsolete, broken, transverse fascia at basal third, a longitudinal one joined to the transverse band at middle and extending arcuately to the suture at the apical third, and a more obsolete arcuate one at the apical fourth. Abdomen beneath rather convex, coarsely and rather sparsely punctate, the punctures very shallow and open on the one side, sparsely clothed with short inconspicuous hairs; intervals finely and obsoletely reticulate; last segment broadly rounded at apex, with 14 rather long, moderately broad, equal teeth, which are rounded at apex, placed close together and bent downward at right angles to the abdomen. Elytral epipleura narrow. Metasternum more coarsely punctured than the abdomen, and rather broadly arcuately emarginate in front. Prosternum rather deeply, arcuately emarginate in front; prosternal process rather broad, three times as wide as the coxal cavities, sides nearly parallel, and the apex broadly rounded; episternum long, flat, and triangular, strongly attenuate anteriorly. Prothoracic epipleura wide and nearly flat, feebly, longitudinally concave behind the antennal groove, which is very deep and extending to the lateral margin near the middle, and parallel to the tibial groove; lateral margin rather acute posteriorly, and nearly rectangular in front of the antennal groove.

Length, 3 mm.; width, 2.25 mm.

Type locality.—Porto Bello, Panama.

Type and *paratypes.*—Cat. No. 25097, U.S.N.M.

Described from three females, all collected by E. A. Schwarz; two of these collected at Porto Bello, Panama, February 26, 1911, and the other one at Paraiso, Canal Zone, Panama, on March 15, 1911.

PACHYSCHELUS IRRORATUS Waterhouse.

Pachyschelus irroratus WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 149, pl. 7, figs. 23, 23*a*.

Described from material collected by Mr. Höge at Mazatlan in Sinaloa, Mexico. It is represented in the National Museum Collection by two specimens collected at Izamal, Yucatan, Mexico, during April, by C. H. T. Townsend, which agree very well with the description.

PACHYSCHELUS CARMINEUS Kerremans.

Pachyschelus carmineus KERREMANS, Ann. Soc. Ent. France, vol. 63, 1894, pp. 420–421.

Described from material collected in the refuse of tobacco imported into Paris, France, from Mexico. The origin of the specimens collected under these conditions should be verified, as tobacco from Brazil, Mexico, and other localities was stored in the same building. The species is unknown to the writer and is placed in the key from the characters given in the original description.

PACHYSCHELUS TRAPEZOIDALIS Waterhouse.

Pachyschelus trapezoidalis WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 151, pl. 7, figs. 24, 24a.

Described from material collected by H. H. Smith, at Chilpancingo in Guerrero, Mexico, at an altitude of 4,600 feet. Mr. Waterhouse also records a specimen from Yolos, Mexico, which differs slightly from the type in having the pubescence more distinctly sandy yellow. The species has been placed in the key from the characters given in the original description.

PACHYSCHELUS SIGNATUS Waterhouse.

Pachyschelus signatus WATERHOUSE Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 150, pl. 8, fig. 17.

The type locality for this species is Cahabon, Guatemala, and was described from material collected by Mr. Champion. It is also recorded from Chiacam and San Juan in Vera Paz, Guatemala, from material taken by the same collector. It is not represented in the National Museum Collection and has been given its position in the key from the characters given in the original description.

PACHYSCHELUS ALBOPICTUS Kerremans.

Pachyschelus albopictus KERREMANS, Ann. Soc. Ent. France, vol. 63, 1894, p. 421.

This species was described from material collected in the refuse of tobacco imported into Paris, France, from Mexico. The species is unknown to the writer, and has been placed in the key solely upon the characters given in the original description.

PACHYSCHELUS MEXICANUS, new species.

Female.—Subtrapeziformis, distinctly longer than wide, strongly narrowed posteriorly, subopaque, piceous, with a violaceous tinge toward the lateral margins; surface moderately pubescent, the pubescence forming irregular designs on the basal half of elytra, and a more distinct transverse undulating fascia at apical third; beneath piceous.

Head feebly convex and deeply embedded in the prothorax, rather feebly, longitudinally grooved from vertex to epistoma, the groove becoming deeper anteriorly; surface with a few large, shallow, obsolete punctures, and sparsely clothed posteriorly with short cinereous hairs. Pronotum feebly convex, nearly four and one-half times as wide as long at middle, much narrower in front than behind, widest at base; sides attenuate from base to apical fourth, then broadly arcuate to the apical angles, which are rectangular; anterior margin deeply, arcuately emarginate for the insertion of the head; base nearly truncate, slightly sinuate at the elytral lobes; hind angles acute, projecting slightly beyond the humeral angles of the elytra and fitting closely to them; surface at sides rather densely punctate, the punctures large, shallow, and open on one side, and becoming obsolete on the disk, sparsely, irregularly clothed with rather long, recumbent, cinereous hairs. Scutellum smooth and glabrous, with the anterior angles acute. Elytra as wide as pronotum at base; humeral angles broadly rounded; sides obliquely attenuate to near the tips, which are broadly subtruncate, the lateral margin feebly serrate, and when viewed from the side is nearly straight, except for an abrupt sinuation for the posterior femora; each elytron with a broad, shallow depression at the base, and a very narrow, deep one between the humerus and lateral margin, extending along margin from the humeral angle to the sinuation in lateral margin, the depression becoming broadly rounded behind the humerus; surface densely, finely punctate, becoming feebly rugose toward the sides, and sparsely, irregularly clothed with rather long, recumbent, cinereous hairs and a few black erect ones intermixed, the white hairs forming irregular designs on the basal half, and a distinct, undulating fascia at apical third; commencing at the margin it is very slightly directed downward, then slightly farther upward, and then, again descending to the suture, there is also an obscure transverse fascia near the apex. Abdomen beneath strongly convex, coarsely and rather sparsely punctate, the punctures very shallow and open on the one side, sparsely clothed with short, recumbent, cinereous hairs; intervals obsoletely reticulate; last segment finely transversely rugose, rather narrowly produced, bent obliquely downward, and deeply, widely arcuately emarginate at apex, with two sharp teeth of equal length on each side of the emargination and two very small acute teeth on the outer side at a much lower level, the portion in front of the marginal groove rather acutely rounded at apex, with a rather deep, narrow, longitudinal groove, extending from the apex to the middle of the segment, the groove with a large puncture at the middle, and bordered on both sides by a series of rather long yellowish hairs. Elytral epipleura narrow. Metasternum more coarsely and deeply punctured than the abdomen, and rather deeply and broadly, arcuately emarginate in front. Prosternum feebly arcuately emarginate anteriorly; prosternal process three times as wide as the coxal cavities, sides slightly expanded behind the coxae, and the apex very broadly rounded; episternum flat, somewhat rectangular, but more attenuate laterally. Prothoracic epipleura wide and nearly flat, with a deep narrow groove behind the antennal groove; lateral margin rectangular, becoming more acute posteriorly; antennal groove deep, following the suture between the episternun and epipleura, extending into the latter to about the middle, and parallel to the tibial groove.

Length, 2.75 mm.; width, 1.75 mm.

Type locality.—Tampico, Mexico.

Type.—Cat. No. 25098, U.S.N.M.

Described from a single female collected by E. A. Schwarz on December 21, 1909.

PACHYSCHELUS JENNINGSI, new species.

Male.—Subtrapeziformis, considerably longer than wide, strongly narrowed posteriorly, shining, piceous, with a strong violaceous tinge; surface moderately pubescent, the pubescence forming irregular transverse undulating fasciae on the elytra; beneath piceous.

Head moderately convex, longitudinally grooved from occiput to epistoma, the groove deep on the vertex and front, becoming feebly defined on the occiput; surface very sparsely, obsoletely punctate, and feebly granulated near the epistoma, and sparsely clothed posteriorly with rather long, recumbent cinereous hairs. Pronotum moderately convex, nearly three and one half times as wide as long at middle, much narrower in front than behind, widest at base; sides strongly, obliquely arcuate from base to apical angles, which are nearly rectangular; anterior margin deeply, arcuately emarginate; base nearly truncate, slightly sinuate at the elytral lobes; hind angles acute, projecting slightly beyond the humeral angles of the elytra and not fitting closely to them; surface sparsely punctate and finely, densely granulated along lateral margin, the punctures becoming very fine and nearly obsolete on the disk, sparsely and irregularly clothed with rather long, recumbent, cinereous hairs. Scutellum smooth and glabrous, with the anterior angles acute. Elytra as wide as pronotum at base; humeral angles obtusely rounded; sides obliquely attenuate to near the tips, which are conjointly rounded, there is also a feeble sinuation at apical third, the lateral margin is strongly serrate and, when viewed from the side, is nearly straight, except for an abrupt sinuation for the posterior femora; each elytron with a broad, shallow depression at base extending arcuately backward to the suture, becoming obsolete on the disk, and with a very narrow, deep groove between the humerus and lateral margin, extending along margin from the humeral angle to a very deep, broad depression behind the humerus, there is also a feeble depression along margin at apex; surface finely, sparsely punctate, and sparsely clothed with rather short, recumbent cinereous pubescence, the white pubescence forming an obsolete irregular fascia at middle, and with numerous white hairs scattered over basal half, an obsolete undulating fascia at apical third, the tips of the undulations connecting posteriorly to a less distinct transverse fascia at apical fourth. Abdomen beneath convex, sparsely and coarsely punctate, the punctures very shallow and open on the one side, sparsely clothed with short, recumbent, cinereous hairs; intervals finely and obsoletely reticulate; last segment rather broadly rounded with a short, acute tooth at apex, on each side of which is a small, oblong depression, the portion in front of the marginal groove acutely angulated. Elytral epipleura very narrow. Metasternum more coarsely punctured than the abdomen, and feebly rectangularly emarginate in front. Prosternum nearly truncate in front; prosternal process wide, three times as wide as coxal cavities, sides parallel, and very broadly, obsoletely rounded at apex; episternum short, flat, and triangular. Prothoracic epipleura wide and nearly flat, with a narrow, deep groove behind the antennal groove; lateral margin nearly rectangular, becoming more acute posteriorly; antennal groove deep, short, following the suture between the episternum and epipleura, and extending into the latter to about the middle, and parallel to the lateral margin.

Female.—Differs from the male in having the last abdominal segment strongly, narrowly produced, and deeply, narrowly arcuately emarginate at apex, with three sharp equal teeth on each side of the emargination, arranged obliquely, and close together, the ventral surface with a moderately deep, longitudinal groove, extending from the apex to near the middle.

Length, 3.1 mm.; wide, 1.7 mm.

Type locality.—Type (male) Panama City, Panama; allotype (female) Paraiso, Canal Zone, Panama.

Type and *allotype.*—Cat. No. 25099, U.S.N.M.

Described from two specimens, one male collected by A. H. Jennings at Panama City, Panama, April 15, 1911, and a female collected by E. A. Schwarz at Paraiso, Canal Zone, Panama, May 6, 1911.

PACHYSCHELUS PUBICOLLIS Waterhouse.

Pachyschelus pubicollis WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 153, pl. 8, fig. 24.

This species was described from material collected at Teapa in Tabasco, Mexico; San Miguel in the Pearl Islands, and from Taboga Islands, Panama; and San Juan in Vera Paz, Guatemala; without designating any of them as the type locality. It is represented in the National Museum Collection by 12 specimens as follows: Eight examples collected at Paraiso, Canal Zone, Panama, from March 5 to April 17, by E. A. Schwarz; two from the same locality collected March 28 and April 10, 1911, by A. H. Jennings; one taken by the same collector at Ancon, Canal Zone, Panama, March 4, 1911; and one collected at Finca Trece Aguas, Alta Vera Paz, Guatemala, at an altitude of 900 feet, April 1, 1906, by Messrs. Schwarz and Barber.

PACHYSCHELUS CUNEIFORMIS, new species.

Male.—Broadly cuneiform, considerably longer than wide, strongly narrowed posteriorly, shining; head and pronotum aeneous; scutellum and elytra dark violaceous; surface sparsely pubescent, the pubescence forming two distinct transverse fasciae on the elytra; beneath piceous, with a slight aeneous reflection.

Head moderately convex, deeply, longitudinally grooved from vertex to epistome; surface nearly smooth, shining, with a few obsolete punctures, and the occiput very sparsely clothed with rather long cinereous hairs. Pronotum moderately convex, three times as wide as long at middle, much narrower in front than behind, widest at base; sides strongly, obliquely arcuate from base to apical angles, which are rectangular; anterior margin broadly, arcuately emarginate; base transversely truncate to the elytral lobe, where it is feebly, arcuately emarginate, and with a more obsolete emargination in front of scutellum; hind angles acute, projecting slightly beyond the humeral angles of the elytra and fitting closely to them; surface rather densely punctate, and finely granulate at the sides, the punctures large and very shallow, becoming obsolete on the disk, sparsely clothed at sides with rather long, recumbent, cinereous hairs. Scutellum smooth and glabrous, with the anterior angles acute. Elytra as wide as pronotum at base; humeral angles obtusely rounded; sides parallel to near the middle, then abruptly, obliquely attenuate to the tips, which are conjointly rounded, the lateral margin feebly serrate, and, when viewed from the side, is nearly straight, except for a feeble sinuation for the posterior femora; each elytron with a very shallow, round depression at the base, and a deeper one between the humerus and lateral margin, extending along margin from humeral angle to a very deep, broad depression behind the humerus; surface sparsely, rather finely punctate, and each elytron with two distinct transverse fasciae as follows: A rather wide undulating one at the middle, commencing at the margin just behind the depression where it is the widest, it curves upward to near the suture, and then turns obliquely downward to the suture, and a narrow straight one at the apical fourth, there are also a few dark, inconspicuous hairs on the basal half and between the fasciae, and a few short cinereous ones at the apex. Abdomen beneath moderately convex, sparsely punctate, the punctures very shallow and obsolete, and clothed with a few very short, recumbent, cinereous hairs; intervals finely and obsoletely reticulate; last segment acutely rounded at apex, the portion in front of marginal groove acutely rounded, with a short, sharp tooth at the apex. Elytral epipleura narrow. Metasternum more densely and coarsely punctured than abdomen, and nearly truncate in front. Prosternum rather broadly, arcuately emarginate in front; prosternal process nearly four times as wide as coxal cavities, sides nearly parallel, the apex nearly truncate, with the angles feebly rounded; episternum short, flat, and triangular. Prothoracic epipleura wide and nearly flat, with a deep, narrow groove behind the antennal groove; lateral margin nearly rectangular; antennal groove rather wide, following the suture between the episternum and epipleura, and extending into the latter to about the middle, and parallel to the tibial groove.

Length, 2.5 mm.; width, 1.6 mm.

Type locality.—Porto Bello, Panama.

Type.—Cat. No. 25100, U.S.N.M.

Described from a unique male collected by E. A. Schwarz, February 15, 1911.

PACHYSCHELUS LATICEPS Waterhouse.

Pachyschelus laticeps WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, pp. 149–150, pl. 8, fig. 16.

This species was described from material collected by Mr. Champion at Tolé, Panama. No specimen has been examined that would fit the description of this species, and it is placed in the key solely upon the characters given in the original description.

PACHYSCHELUS BIFASCIATUS Waterhouse.

Pachyschelus bifasciatus WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, pp. 151–152, pl. 8, fig. 19.

The type locality for this species is Teleman in Vera Paz, Guatemala, and was described from material collected by Mr. Champion. It is represented in the National Museum Collection by a specimen collected at Finca Trece Aguas, Alta Vera Paz, Guatemala, at an altitude of 900 feet, April 3, 1906, by Schwarz and Barber, and another example collected at Paraiso, Canal Zone, Panama, April 30, 1911, by E. A. Schwarz.

PACHYSCHELUS PURPUREIPENNIS Waterhouse.

Pachyschelus purpureipennis WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 144, pl. 8, fig. 8.

This species was described from material collected by Mr. Champion at Bugaba and Volcan de Chiriqui, Panama, at an altitude of 3,000 feet. It is represented in the National Museum Collection by two examples collected at Paraiso, Canal Zone, Panama, May 6, 1911, by E. A. Schwarz. Both of the examples are females and vary slightly in color; one has the pronotum uniformly black and the elytra uniformly purple, while in the other the pronotum is black, with the sides narrowly margined with green, and the elytra is purple, with a strong bluish tinge on the disk.

PACHYSCHELUS BICOLOR Kerremans.

Pachyschelus bicolor Kerremans, Ann. Soc. Ent. France, vol. 63, 1894, p. 420.

Described from material collected in the refuse of tobacco imported into Paris, France, from Mexico. The species is unknown to the writer, and has been given its position in the key solely upon the charactersy gven in the original description.

PACHYSCHELUS ELEGANS Waterhouse.

Pachyschelus elegans WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 152, pl.8. fig. 20.

This species was described from material collected by Mr. Champion on Taboga Island, Panama. It is not represented by any material in the National Museum Collection, and is placed in the key from the characters given in the original description.

PACHYSCHELUS ALBOFASCIATUS, new species.

Male.—Broadly cuneiform, considerably longer than wide, strongly narrowed posteriorly, shining, uniformly, piceous, with a strong violaceous tinge above; surface rather sparsely pubescent, the pubescence forming transverse undulating fasciae on the elytra; beneath piceous, with a feeble aeneous reflection.

Head rather strongly convex, longitudinally grooved from occiput to epistoma, the groove rather deep on the front and vertex, becoming feebly defined on the occiput; surface very sparsely, obsoletely punctate, with a few rather long, cinereous hairs scattered over the vertex and occiput; intervals densely granulated on the front, becoming smoother posteriorly. Pronotum moderately convex, about three times as wide as long at the middle, much narrower in front than behind, widest at base; sides strongly, obliquely arcuate from base to apical angles, the edge strongly margined, and apical angles rectangular; anterior margin broadly arcuately emarginate; base nearly truncate, acutely emarginate at elytral lobes, and obsoletely emarginate in front of scutellum; hind angles acute, projecting beyond the humeral angles of the elytra and fitting closely to them; surface obsoletely depressed toward the sides, sparsely punctate, and very finely, densely granulate at the sides, the punctures large and very shallow, becoming obsolete on the disk, very sparsely clothed with long, recumbent, cinereous hairs. Scutellum obsoletely punctate, and glabrous, with the anterior angles rather broadly rounded. Elytra as wide as pronotum at base; humeral angles obtusely rounded; sides parallel to near the middle, then abruptly, obliquely attenuate to near the tips, which are conjointly broadly rounded, the lateral margin strongly serrate, and, when viewed from the side, is nearly straight, except for an abrupt sinuation for the posterior femora; each elytron with a broad, rather deep depression at the base, and a narrow, deeper one between the humerus and lateral margin, extending along margin from the humeral angle to near the middle, and becoming much broader posteriorly; surface finely and rather densely punctate, the punctures becoming much denser toward the humeral regions, sparsely, irregularly clothed with rather long, recumbent cinereous pubescence, forming designs on each elytron as follows: An irregular area behind the scutellum; a transverse fascia at the middle, commencing at margin just behind the impression, it is directed downward to the middle, then upward, and joined anteriorly by a short fascia, then descending again to the suture; a narrow fascia commencing from the margin at apical fourth, extending obliquely upward to near the suture, then turning obliquely downward to the suture; there are also a few obsolete hairs near the apex. Abdomen beneath moderately convex, sparsely and obsoletely punctate, the punctures very shallow and open on the one side, sparsely clothed with a few very short, recumbent, cinereous hairs; intervals finely and densely reticulate; last segment broadly rounded, with a feeble tooth at apex, the portion in front of marginal groove acutely rounded, with a sharp tooth at the tip. Elytral epipleura narrow. Metasternum more coarsely and densely punctured than abdomen, and broadly arcuately emarginate in front. Prosternum feebly, arcuately emarginate in front; prosternal process about three times as wide as the coxal cavities, sides feebly expanded behind the coxae, and very broadly rounded at the apex; episternum short, flat, and triangular. Prothoracic epipleura wide and nearly flat, with a deep, narrow groove behind the antennal groove; lateral margin nearly rectangular, becoming more acute posteriorly; antennal groove deep and rather wide, following the suture between the episternum and epipleura, extending into the latter to about the middle, and parallel to the lateral margin.

Female.—Differs from the male in having the last abdominal segment strongly, narrowly produced, and very widely, deeply, rectangularly emarginate at apex, with four sharp subequal teeth arranged obliquely on each side of the emargination, the ventral surface with a moderately deep, longitudinal groove, extending from the apex to near the middle.

Length, 2.5 mm.; width, 1.7 mm.

Type locality.—Paraiso, Canal Zone, Panama.

Type, allotype, and *paratype.*—Cat. No. 25101, U.S.N.M.

Described from three specimens, one male and two females, all of which were collected by E. A. Schwarz at the type locality. Male collected January 27, 1911; females, January 16 and April 18, 1911.

PACHYSCHELUS ATRIFRONS, new species.

Male.—Broadly cuneiform, considerably longer than wide, strongly narrowed posteriorly, shining, uniformly piceous, with a bluish-violaceous tinge above; surface sparsely pubescent, the pubescence forming narrow transverse fasciae on the elytra; beneath piceous.

Head moderately convex; front feebly, longitudinally grooved; surface with a few obsolete punctures, from which arises a short cinereous hair; intervals obsoletely granulated on the front, becoming smooth and shining on the occiput. Pronotum rather strongly convex, three times as wide as long at the middle, much narrower in front than behind, widest at base; sides strongly obliquely arcuate from base to apical angles, the edge strongly margined, and apical angles rectangular; anterior margin broadly, arcuately emarginate; base transversely truncate to elytral lobes, where it is acutely emarginate, more obsoletely emarginate in front of scutellum; hind angles acute, projecting considerably beyond the humeral angles of the elytra but not fitting very closely to them; surface sparsely punctate, and narrowly, densely granulate along the sides, the punctures large and very shallow, becoming obsolete on disk, and with a few very short, cinereous hairs. Scutellum smooth and glabrous, with the anterior angles rather acute. Elytra as wide as pronotum at base; humeral angles obtusely rounded; sides parallel to basal third, then abruptly, obliquely attenuate to near the tips, which are conjointly rounded, the lateral margin strongly serrate, and, when viewed from the side, is nearly straight, except for a feeble sinuation for the posterior femora; each elytron with an obsolete basal impression, and a very narrow one extending along the lateral margin from near the humeral angle to a broad, very deep impression behind the humerus; surface sparsely and rather coarsely punctate, and sparsely, irregularly clothed with rather long, recumbent, cinereous, and blackish hairs, the cinereous pubescence forming on each elytron a narrow transverse fascia at the middle, and a narrow, somewhat undulating one at the apical third. Abdomen beneath strongly convex, very sparsely and obsoletely punctate, with a few moderately long, recumbent, cinereous hairs; intervals finely and densely reticulate; last segment broadly rounded, with a long tooth at apex, which is parallel and extending slightly beyond the tips of the elytra, the portion in front of the marginal groove acutely rounded, with a sharp tooth at the tip. Elytral epipleura narrow. Metasternum more coarsely punctured than abdomen, and broadly, arcuately emarginate in front. Prosternum sparsely pubescent, and feebly, arcuately emarginate anteriorly; prosternal process three times as wide as the coxal cavities, sides distinctly expanded behind the coxae, and very broadly rounded at apex; episternum short, flat, and triangular. Prothoracic epipleura wide and nearly flat, with a deep, very narrow groove behind the antennal groove; lateral margin rectangular, becoming more acute posteriorly; antennal groove deep and rather wide, following the suture between the episternum and epipleura, extending into the latter to about the middle, and parallel to the lateral margin.

Length, 2.7 mm.; width, 1.65 mm.

Type locality.—Paraiso, Canal Zone, Panama.

Type and *paratype.*—Cat. No. 25102, U.S.N.M.

Described from two male specimens. The type was collected by E. A. Schwarz, March 18, 1911. A paratype, which differs very slightly from the type in having the upper surface of a more brownish-violaceous color, was collected by A. H. Jennings at the type locality April 10, 1911.

PACHYSCHELUS SULCIFRONS, new species.

Male.—Broadly cuneiform, considerably longer than wide, strongly narrowed posteriorly, shining, uniformly dark aeneous above; surface moderately pubescent, the pubescence forming transverse undulating fasciae on the elytra; beneath piceous.

Head moderately convex, longitudinally grooved from occiput to epistoma, the groove rather deep on the front and vertex, becoming feebly defined on the occiput; surface sparsely, obsoletely punctate, and sparsely clothed, except on the front, with rather long cinereous hairs; intervals smooth except near the epistoma, where they are finely granulated. Pronotum moderately convex, three times as wide as long at middle, much narrower in front than behind, widest at the base; sides strongly, obliquely arcuate from base to apical angles, which are nearly rectangular; anterior margin broadly and rather deeply, arcuately emarginate; base nearly truncate, acutely emarginate; at elytral lobes, and obsoletely emarginate in front of scutellum; hind angles acute, projecting very slightly beyond the humeral angles of the elytra and fitting closely to them; surface broadly, obsoletely depressed toward the sides, and rather densely punctate, the punctures large and very shallow, becoming finer and obsolete on the disk, sparsely and irregularly clothed with long, recumbent, cinereous hairs. Scutellum smooth and glabrous, with the anterior angles acute. Elytra as wide as pronotum at base; humeral angles obtusely rounded; sides parallel to basal third, then abruptly, obliquely attenuate to near the tips, which are conjointly broadly rounded, the lateral margin strongly serrate, and, when viewed from the side, is nearly straight, except for an abrupt sinuation for the posterior femora; each elytron with a broad, shallow depression at the base, and a narrow, deeper one between the humerus and lateral margin, extending along margin from the humeral angle to a broad deep depression behind the humerus; surface finely, rather densely punctate, and sparsely, irregularly clothed with rather long, recumbent, yellowish pubescence, the pubesence on each elytron forming designs as follows: An elongate area behind the scutellum; a narrow fascia extending from humerus obliquely backward toward the suture; a transverse fascia at the middle, commencing at the margin just behind the depression, it extends downward, then obliquely upward and joining the fascia from the humerus, and then descends again to the suture; the posterior fascia, commencing from the margin at apical fourth, extends transversely to the middle, then horizontally toward the base, and then turning obliquely downward to the suture; there is also an obsolete transverse fascia at the apex. Abdomen beneath moderately convex, sparsely and obsoletely punctate, clothed with a few inconspicuous recumbent, cinereous hairs; intervals finely and densely reticulate; last segment broadly rounded, with a feeble tooth at apex, the portion in front of marginal groove acutely rounded, with a sharp tooth at the tip. Elytral epipleura narrow. Metasternum more coarsely punctured than abdomen, and nearly truncate in front. Prosternum feebly, arcuately emarginate in front; prosternal process about three times as wide as the coxal cavities, sides nearly parallel, and broadly rounded at apex; episternum short, flat, and triangular. Prothoracic epipleura wide and nearly flat, with a deep, narrow groove behind the antennal groove; lateral margin rectangular, becoming more acute posteriorly; antennal groove deep and rather wide, following the suture between the episternum and epipleura, and extending into the latter to about the middle, and parallel to the lateral margin.

Female.—Differs from the male in having the last abdominal segment strongly, narrowly produced, and very broadly, arcuately, but not deeply emarginate at apex, with four very short subequal teeth arranged obliquely on each side of the emargination; ventral surface with a large, round, and rather deep depression at the apex.

Length, 2.4 mm.; width, 1.5 mm.

Type locality.—Paraiso, Canal Zone, Panama.

Type and *allotype.*—Cat. No. 25103, U.S.N.M.

Described from two specimens, male and female, collected by E. A. Schwarz at the type locality. The male was collected April 6, 1911, and the female May 7, 1911.

PACHYSCHELUS UNIFASCIATUS, new species.

Male.—Broadly cuneiform, considerably longer than wide, strongly narrowed posteriorly, shining, uniformly bottle-green above; elytra with a narrow transverse pubescent fascia at apical third; beneath piceous.

Head strongly convex, with a short, longitudinal depression on the front; surface shining, with a few very shallow punctures intermixed with finer obsolete ones. Pronotum moderately convex, three and one-half times as wide as long at middle, much narrower in front than behind, widest at base; sides strongly, obliquely arcuate from base to apical angles, which are rectangular; anterior margin rather deeply, arcuately emarginate; base nearly truncate, feebly sinuate at the elytral lobes, hind angles acute, projecting slightly beyond the humeral angles of the elytra and fitting closely to them; surface broadly, obsoletely depressed at the posterior angles, glabrous, with a few very shallow punctures intermixed with finer, obsolete ones, and finely, densely granulated in the depressed areas at posterior angles. Scutellum obsoletely punctate, and glabrous, with the anterior angles nearly rectangular. Elytra as wide as pronotum at base; humeral angles obtusely rounded; sides parallel to near the middle, then abruptly, obliquely attenuate to near the tips, where they are more strongly narrowed, tips separately and rather acutely rounded, the lateral margin rather strongly serrate, and when viewed from the side, is nearly straight, except for an abrupt sinuation for the posterior femora; each elytron with a deep, narrow depression between the humerus and lateral margin, extending along margin from the humeral angles to a very deep, broad depression behind the humerus, basal depression not present; surface finely, sparsely punctate, and sparsely clothed with short, inconspicuous dark hairs, and with a narrow, transverse fascia of rather short, recumbent, cinereous hairs at apical third. Abdomen beneath moderately convex, sparsely and rather finely punctate, with a few inconspicuous hairs; intervals finely and densely reticulate; last segment broadly rounded, with a short tooth at the apex, the portion in front of marginal groove acutely angulated at tip. Elytral epipleura narrow. Metasternum more coarsely punctured than the abdomen, and feebly emarginate in front. Prosternum obsoletely emarginate in front; prosternal process about three times as wide as the coxal cavities, sides slightly expanded behind the coxae, and very broadly rounded at apex; episternum short, flat, and triangular. Prothoracic epipleura wide and nearly flat, with a deep longitudinal groove behind the antennal groove; lateral margin rectangular, becoming acute posteriorly; antennal groove deep and rather wide, following the suture between the episternum and epipleura, and extending into the latter to about the middle, and nearly parallel to the lateral margin.

Female.—Differs from the male in having the last abdominal segment slightly produced, and obsoletely emarginate at apex, truncate and feebly sinuate on each side of the emargination; the ventral surface with a moderately deep, longitudinal groove, extending from the apex to apical third. The apex of the abdomen is probably somewhat deformed in this specimen.

Length, 3 mm.; width, 1.9 mm.

Type locality.—Paraiso, Canal Zone, Panama.

Type and *allotype.*—Cat. No. 25104, U.S.N.M.

Described from two specimens, male and female, both of which were collected by E. A. Schwarz at the type locality. The male was collected April 3, 1911, and the female May 10, 1911.

PACHYSCHELUS BIGUTTATUS Waterhouse.

Pachyschelus biguttatus WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 153, pl. 8, fig. 22.

This species was described from material collected by Mr. Champion at Bugaba at an altitude of 800 to 1,500 feet, Volcan de Chiriqui at an altitude of 2,000 to 4,000 feet, and David, all in the Republic of Panama, without designating any definite type locality. It is represented in the National Museum Collection by one example collected at Paraiso, Canal Zone, Panama, February 8, 1911, by E. A. Schwarz; and two other specimens collected at Gatun, Canal Zone, Panama, April 7, 1911, one by E. A. Schwarz and the other one by A. H. Jennings.

PACHYSCHELUS STICTICUS Waterhouse.

Pachyschelus sticticus WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 153, pl. 8, fig. 23.

Described from material collected by Mr. Champion at Tamahu, Senahu, and San Juan in Vera Paz, Guatemala. It it represented in the National Museum Collection by three examples collected at Finca Trece Aguas, Alta Vera Paz, Guatemala, at an altitude of 900 feet, during March and April, 1906, by Messrs. Schwarz and Barber.

PACHYSCHELUS UNDULATUS Waterhouse.

Pachyschelus undulatus WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 151, pl. 8. fig. 18.

This species was described from material collected by Mr. Champion at Bugaba and San Lorenzo, Panama, without designating any definite type locality. No specimens of the species have been examined, and it has been placed in the key from the characters given in the original description.

PACHYSCHELUS AZUREUS Waterhouse.

Pachyschelus azureus WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, pp. 152–153, pl. 8, fig. 21.

Described from material collected by Mr. Champion at Cahabon, Teleman, Chacoj, and Chiacam in Vera Paz, and El Tumbador at an altitude of 2,500 feet, all in Guatemala. It is represented in the National Museum Collection by one example from Livingston, Guatemala, May 12, 1906, and three specimens from Finca Trece Aguas, Alta Vera Paz, Guatemala, at an altitude of 900 feet, collected during April, 1906, by Messrs. Schwarz and Barber.

PACHYSCHELUS HYDROPOROIDES Waterhouse.

Pachyschelus hydroporoides WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 140.

This species is rather widely distributed and is a very convex and regularly oval species, superficially resembling some of the *Hydropori*.

It was described from material collected at Rio Hondo, Belize, British Honduras; Chacoj and San Geronimo in Vera Paz, Guatemala; Costa Rica; and Volcan de Chiriqui, Panama, at an altitude of 3,000 to 4,000 feet, without designating any of these places as the type locality. No specimens have been examined by the writer, and it is placed in the key solely upon the characters given in the original description.

PACHYSCHELUS OBSOLETEPILOSUS, new species.

Female.—Broadly ovate, only slightly longer than wide, broadly rounded in front, more obliquely narrowed posteriorly, subopaque; head, pronotum, and elytra dark green; scutellum piceous; elytra with a few very short, inconspicuous, cinereous hairs protruding from the punctures; beneath piceous, more shining than above, with a slight aeneous reflection.

Head feebly convex and deeply embedded in the prothorax, feebly, longitudinally grooved on the front; surface sparsely, coarsely punctate, from each puncture arising a very short, obsolete hair; intervals with numerous finer punctures, and finely, densely granulated. Pronotum moderately convex, four and one-half times as wide as long at the middle, much narrower in front than behind, widest at base; sides strongly, obliquely arcuate from base to apical angles, which are nearly rectangular; anterior margin deeply, arcuately emarginated for the insertion of the head; base nearly truncate, abruptly sinuate at the elytral lobes; hind angles acute, projecting slightly beyond the humeral angles of the elytra and fitting closely to them; surface glabrous, rather densely punctate, the punctures larger and denser on the sides; intervals densely granulated, with a few fine punctures intermixed, the granulation much denser and more opaque on the sides. Scutellum finely, densely granulated, glabrous, with the anterior angles acute. Elytra as wide as pronotum at base, widest at basal third; humeral angles broadly rounded; sides broadly rounded to the middle, then arcuately attenuate to the tips, which are conjointly, very broadly rounded, the lateral margin entire, and when viewed from the side is slightly arcuate, with an abrupt sinuation for the posterior femora; each elytron with a broad, obsolete basal depression, and a deeper narrow one between the humerus and lateral margin, extending along margin from near the humeral angle to a very broad, deep depression behind the humerus, and then continuing posteriorly for a short distance along the margin; surface coarsely and rather densely punctate, with the intervals finely and densely reticulate, sparsely clothed with a few inconspicuous, short, cinereous hairs. Abdomen beneath feebly convex, sparsely and obsoletely punctate, with a few very short, inconspicuous hairs; intervals finely, and densely reticulate, with a few oblique rugae near the posterior legs; last segment is feebly sinuate on each side and slightly produced, truncate at the apex, with a narrow V-shaped incision at the middle, and three short, blunt, equidistant teeth on each side; the portion in front of the marginal groove with two large, acute, distant teeth at the apex. Elytral epipleura narrow. Metasternum more coarsely and densely punctured than the abdomen, and nearly truncate in front. Prosternum feebly, arcuately emarginate anteriorly; prosternal process about four times as wide as the coxal cavities; sides slightly expanded behind the coxae, truncate at the apex with the angles broadly rounded; episternum flat, somewhat rectangular, slightly more attenuate anteriorly. Prothoracic epipleura wide and nearly flat, with a deep, narrow groove behind the antennal groove; lateral margin rectangular, becoming acute posteriorly; antennal groove deep and wide, following the suture between the episternum and epipleura, extending into the latter to the tibial groove and parallel to the lateral margin.

Length, 3.1 mm.; width, 2.6 mm.

Type locality.—Piedras Negras, Costa Rica.

Type.—Cat. No. 25105, U. S. N. M.

Described from a unique female in the National Museum Collection labeled "Piedr. Negras, Costa Rica, Coll. Schild and Burgdorf."

PACHYSCHELUS CENTRALIS Waterhouse.

Pachyschelus centralis WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 148.

This is one of the most rotund species and was described from material collected by Mr. Champion at El Tumbador, Guatemala, at an altitude of 2,500 feet. It is not represented in the National Museum Collection, and it has been given its position in the key solely upon the characters given in the original description.

PACHYSCHELUS OVALIS Waterhouse.

Pachyschelus ovalis WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 140.

Described from material collected at Rio Hondo, British Honduras; San Geronimo and Chiacam in Vera Paz, and El Tumbador, Guatemala, without designating any type locality. No specimens have been examined of this species, and it is placed in the key from the characters given in the original description.

PACHYSCHELUS ASTRAEUS Waterhouse.

Pachyschelus astraeus WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 147.

This species was described from material collected at Cordoba and Atoyac in Vera Cruz, Mexico. It is not represented in the National Museum Collection, and has been placed in the key from the characters given in the original description.

PACHYSCHELUS DISCOIDALIS Waterhouse.

Pachyschelus discoidalis WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, pp. 145–146, pl. 8, fig. 11.

This beautiful rotund species was described from material collected by Mr. Champion at Volcan de Chiriqui, Panama, at an elevation of 3,000 to 4,000 feet. It is represented in the National Museum Collection by a single female collected at Zent, 20 miles from the Port Limon, Costa Rica, September 26, by Frederick Knab.

PACHYSCHELUS MODESTUS Waterhouse.

Pachyschelus modestus WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 147, pl. 8, fig. 14.

The type locality for this species is Bugaba, Panama, and was described from material collected by Mr. Champion. Waterhouse also records a female from Volcan de Chiriqui, Panama, which has the purple color on the elytra more extended than in the type. There are no specimens of this species in the National Museum Collection, and it has been placed in the key from the characters given in the original description.

PACHYSCHELUS AVERSUS Waterhouse.

Pachyschelus aversus WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, pp. 146–147, pl. 8, fig. 13.

This species was described from material collected by Sallé at Cordoba, Mexico. No specimens have been seen by the writer that will agree with the description given for these species, and its position in the key is based entirely upon the characters given in the original description.

PACHYSCHELUS SUBOPACUS, new species.

Male.—Broadly ovate, slightly longer than wide, more strongly narrowed behind than in front, subopaque, glabrous dark cyaneous; head and pronotum with a greenish tinge; elytra with a rather strong aeneous tinge on the disk; beneath piceous, more shining than above, with a feeble aeneous reflection.

Head feebly convex and rather deeply embedded in the prothorax; front obsoletely, longitudinally grooved; surface sparsely but distinctly punctate, with the intervals obsoletely granulated. Pronotum moderately convex, four times as wide as long at the middle, much narrower in front than behind, widest at base; sides strongly, obliquely arcuate from base to apical angles, the edge strongly margined and apical angles rectangular; anterior margin deeply, arcuately emarginate; base nearly truncate, rather strongly sinuate at elytral lobes; hind angles acute, projecting slightly beyond the humeral angles of the elytra and fitting closely to them; surface glabrous, sparsely punctate, and very densely finely granuated, the punctures large and distinct at the sides, becoming smaller and obsolete on the disk. Scutellum sparsely, finely punctate and finely, densely granulated, glabrous, with the anterior angles nearly rectangular. Elytra as wide as pronotum at base, widest at basal fourth; humeral angles broadly rounded; sides broadly rounded to middle, then arcuately attenuate to the tips, which are conjointly broadly rounded, the lateral margin rather strongly serrate, and when viewed from the side is broadly arcuate, with a feeble sinuation for the posterior femora; each elytron with a broad, obsolete depression at the base, and a deeper one between the humerus and lateral margin, extending along the margin from the humeral angle to a round, deep depression behind the humerus, and then extending posteriorly along the margin, causing the elytron to have an obsolete lateral carina; surface coarsely and rather densely punctate, the punctures arranged in rows on the disk, the intervals finely, densely punctate and finely reticulate, sparsely clothed with very short, inconspicuous hairs. Abdomen beneath feebly convex, sparsely and rather finely punctate, with a few very short, inconspicuous hairs; intervals finely and densely reticulate; last segment rather acutely angulated at apex, with the margin flattened, the portion in front of the marginal groove a little more broadly angulated than the outer portion. Elytral epipleura narrow. Metasternum more coarsely punctured than the abdomen, and broadly, arcuately emarginate in front. Prosternum very feebly arcuately emarginate anteriorly; prosternal process about four times as wide as the coxal cavities, sides nearly parallel, and very broadly rounded at apex; episternum short, flat, and triangular. Prothoracic epipleura wide and nearly flat, with a deep, narrow groove behind the antennal groove, and a more shallow depression between it and the lateral margin, which is rather acute; antennal groove deep and wide, following the suture between the episternum and epipleura, extending into the latter to a little beyond the middle, and nearly parallel to the lateral margin.

Female.—Differs from the male in being of a darker blue color, and having the last abdominal segment narrowed and feebly produced at the apex, with eight teeth arranged in a semicircle, the central pair distinctly more widely separated than the others, and the two inner pairs a little shorter than the outer ones, the portion in front of the marginal groove with a large round lobe at apex, and the surface broadly transversely concave.

Length, 3.4 mm.; width, 2.4 mm.

Type locality.—Type (male) Trinidad River, Panama; allotype (female) Ancon, Canal Zone, Panama.

Type and *allotype.*—Cat. No. 25106, U.S.N.M.

Described from two specimens, male and female. The type was collected by August Busck May 7, 1911, and the allotype by A. H. Jennings.

PACHYSCHELUS NIGRICOLLIS Waterhouse.

Pachyschelus nigricollis WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 148, pl. 7, figs. 21, 21*a*.

This species was described from material collected by Sallé at Cordoba, Mexico. No specimens of this species have been examined by the writer, and it is placed in the key from the characters given in the original description.

PACHYSCHELUS COMPACTUS Waterhouse.

Pachyschelus compactus WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, pp. 138–139, pl. 7, figs. 15, 15*a*.

This small, oval species is the most variable in color of all the species in the genus. The typical form was described from material collected by Mr. Champion at Bugaba at an altitude of 1,000 feet, and Volcan de Chiriqui at an altitude of 2,500 to 4,000 feet, all in the Republic of Panama. It is also reported from the following localities: David, San Miguel in the Pearl Islands, Panama; Teapa in Tabasco, Atoyac in Vera Cruz, Mexico; San Juan and Chiacam in Vera Paz, and El Tumbador, Guatemala; and Belize, British Honduras. It is represented in the National Museum Collection by four examples collected at Porto Bello, Panama, during February and March, 1911, by E. A. Schwarz. Three of these are the typical form in which the head and pronotum are dark blue, and the elytra dark blue or green. The other specimen, which was taken with the typical form, is the variety with the head and pronotum cupreous, and the elytra dark blue, with a greenish tinge.

PACHYSCHELUS CHAPUISI (Dugès).

Brachys chapuisi DUGÈS, La Naturaleza, ser. 2, vol. 2, 1891, p. 36, pl. 2, fig. 63.

This species was described from Tupatora, Mexico, and placed in the genus *Brachys* by Dugès. There is a female specimen in the National Museum Collection, which was received for determination from Eugenio Dugès a number of years previous to the publication of his description, and labeled in his own handwriting, "#2030, *Brachys chapuisi*, E. Dug." without any locality given. This specimen probably was taken from the same set from which he described the species a few years later. Four specimens, two males and two females, were received from Prof. H. F. Wickham, which were collected by himself at Durango and Tepehuanes, State of Durango, Mexico. These specimens are exactly like the example received from Dugès.

PACHYSCHELUS DEPLANATUS (Chevrolat).

Lius deplanatus CHEVROLAT, Silbermann's Rev. Ent., vol. 5, 1838, pp. 104–105.

This species was described in the genus *Lius* from material collected at Orizaba, Mexico. It is very closely allied to *Pachyschelus chapuisi* (Dugès), but Chevrolat states that *deplanatus* has the underside of the body blackish-green, while in *chapuisi*, there is not the slightest tinge of green on the underside. The species is not represented in the National Museum Collection, and it is placed in the key solely upon the characters given in the original description.

PACHYSCHELUS UNICOLOR, new species.

Male.—Subtrapeziformis, considerably longer than wide, strongly narrowed posteriorly, shining, glabrous, uniformly piceous, with a feeble violaceous reflection on the elytra; beneath piceous.

Head strongly convex, feebly, longitudinally grooved from vertex to epistoma; surface sparsely, but distinctly punctate, and finely, densely granulated over entire surface. Pronotum moderately convex, not quite three times as wide as long at the middle, much narrower in front than behind, widest at base; sides strongly, obliquely arcuate from base to apical angles, which are rectangular; anterior margin broadly and rather deeply arcuately emarginate; base nearly truncate, abruptly sinuate at elytral lobes; hind angles acute, scarcely projecting beyond the humeral angles of the elytra and fitting closely to them; surface glabrous, rather densely punctate and finely, densely granulated at the sides, the punctures large and very shallow, becoming obsolete on the disk. Scutellum smooth and glabrous, the anterior angles acute. Elytra as wide as pronotum at base; humeral angles obtusely rounded; sides obliquely attenuate from base to the tips, and slightly sinuate near the middle, tips conjointly broadly rounded, the lateral margin feebly serrate, and when viewed from the side is nearly straight, except for a slight sinuation for the posterior femora; each elytron with an obsolete depression at the base, and a broad, deep one along lateral margin behind the humerus; surface glabrous, sparsely and coarsely punctate, the punctures very shallow on the disk, becoming feebly rugose in the humeral regions, the intervals rather smooth, becoming finely, densely granulated at the sides. Abdomen beneath strongly convex, sparsely and obsoletely punctate, with a few very short inconspicuous hairs; intervals finely and densely reticulate; last segment broadly rounded, with an obsolete tooth at the tip, the portion in front of the marginal groove rather acutely angulated at apex. Elytral epipleura narrow. Metasternum more coarsely punctured than abdomen, and nearly truncate in front. Prosternum feebly, arcuately emarginate anteriorly; prosternal process about three times as wide as the coxal cavities; sides slightly expanded behind the coxae, and broadly rounded at apex; episternum short, flat, and triangular. Prothoracic epipleura wide and nearly flat, with a deep narrow groove behind the antennal groove; lateral margin rectangular; antennal groove deep, following the suture between the episternum and epipleura, extending into the latter to the tibial groove, and parallel to the lateral margin.

Length, 2.5 mm; width, 1.5 mm.

Type locality.—Panama City, Panama.

Type.—Cat. No. 25107, U.S.N.M.

Described from a single male collected by E. A. Schwarz, January 31, 1911.

PACHYSCHELUS ARDENS Waterhouse.

Pachyschelus ardens WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 144, pl. 8, fig. 1.

The type locality is Cordoba, Mexico, and was described from material collected by Sallé. It is not represented in the National Museum Collection, and has been given its position in the key entirely upon the characters given in the original description.

PACHYSCHELUS AFFINIS Waterhouse.

Pachyschelus affinis WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, pp. 143-144, pl. 8, fig. 7.

This species was described from single examples collected by Mr. Champion at each of the following localities in Panama: Bugaba, Volcan de Chiriqui, 3,000 feet, and Pena Blanca, 3,000 feet. Waterhouse does not designate any of these places as the type locality. The writer has not been able to examine any specimens of this species, and it is placed in the key solely upon the characters given in the original description.

PACHYSCHELUS GRANULOSICOLLIS Waterhouse.

Pachyschelus granulosicollis WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 146, pl. 7, fig. 20.

This species was described from material collected by Mr. Champion at San Geronimo, Guatemala. No specimens have been examined, and it is placed in the key from the characters given in the original description.

PACHYSCHELUS CUPRICAUDA, new species.

Male.—Broadly cuneiform, considerably longer than wide, strongly narrowed posteriorly, shining, nearly glabrous; head and sides of pronotum bright green; scutellum and disk of pronotum bluish-green; elytra cyaneous, with the apical third of a bright reddish-coppery color, the coppery area narrowly margined anteriorly with a strong violaceous color; beneath piceous.

Head strongly convex, feebly, longitudinally grooved from vertex to epistoma; surface sparsely but distinctly punctate, and finely granulated, the granulation dense and as prominent as the punctation on the front, but becoming smoother on the occiput. Pronotum moderately convex, three times as wide as long at the middle; much narrower in front than behind, widest at base; sides strongly obliquely arcuate from base to apical angles, which are rectangular; anterior margin deeply, arcuately emarginate; base nearly truncate, abruptly sinuate at elytral lobes; hind angles acute, scarcely projecting beyond the humeral angles of the elytra and fitting closely to them; surface sparsely punctate, and very densely granulated at the sides, the punctures large and very shallow, very sparsely clothed with short, inconspicuous hairs. Scutellum finely, densely granulated, and glabrous, the anterior angles acute. Elytra as wide as pronotum at base, slightly wider at basal fourth; humeral angles obtusely rounded; sides feebly rounded to near the middle, then obliquely attenuate to near the tips, which are conjointly rounded; the lateral margin feebly serrate, and when viewed from the side is nearly straight, with scarcely any sinuation for the insertion of the posterior femora; each elytron with a shallow depression between the humerus and lateral margin, extending along margin from the humeral angles to a broad, deep depression behind the humerus, and with only a trace of a basal depression; surface rather densely and coarsely punctate, the punctures becoming obsolete on the coppery colored apical area, where the surface is rather finely and densely reticulate, sparsely clothed with very short, inconspicuous hairs. Abdomen beneath moderately convex, sparsely and very finely punctate, and clothed with a few inconspicuous hairs; intervals very finely and obsoletely reticulate; last segment rather acute at the apex, with the portion in front of the marginal groove broadly rounded, with an acute tooth at the apex. Elytral epipleura narrow. Metasternum more coarsely punctured than the abdomen, the punctures large aud very shallow, and rather deeply emarginate in front. Prosternum feebly, arcuately emarginate in front; prosternal process rather wide, about four times as wide as the coxal cavities, sides nearly parallel, and very broadly rounded at apex; episternum short, flat, and triangular. Prothoracic epipleura wide and nearly flat; antennal groove deep, following the suture between the episternum and prothoracic epipleura into the latter, and extending to the lateral margin behind the middle, and nearly parallel to it; lateral margin nearly rectangular.

Female.—Differs from the male in having the head and pronotum of a uniform bluish-green color, and the last abdominal segment feebly produced at apex, with four teeth placed slightly obliquely on each side, the two sets of teeth separated by a very narrow space, the first tooth is rather acute and separated at base, second and third teeth broad, parallel, broadly rounded at apex and connate at base, and the fourth one very acute and slightly shorter than the others; the portion in front of the marginal groove broadly rounded at apex without median depression.

Length, 2.6 mm.; width, 1.75 mm.

Type locality.—Paraiso, Canal Zone, Panama.

Other localities.—Taboga Island, Canal Zone, Panama.

Type, allotype, and *paratypes.*—Cat. No. 25108, U.S.N.M.

Described from a series of 66 specimens. The type, allotype, and six paratypes were collected at Paraiso, Canal Zone, Panama, by E. A. Schwarz between April 2 and April 18, 1911; one specimen collected at Paraiso, Canal Zone, Panama, April 10, 1911, and another one at Taboga Island, Panama, by A. H. Jennings; and the balance of specimens were reared from living leaves, from an undetermined plant collected on Taboga Island, Canal Zone, Panama, by August Busck July, 1907.

Some of the paratypes from Taboga Island have the head and pronotum strongly violaceous.

PACHYSCHELUS FULGENS Waterhouse.

Pachyschelus fulgens WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 141, pl. 7, fig. 17.

Described from material collected by Mr. Conradt at Coban in Vera Paz, Guatemala. It is not represented in the National Museum Collection, and is placed in the key entirely upon the characters given in the original description.

PACHYSCHELUS CONSTANS Waterhouse.

Pachyschelus constans WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 137.

This species was described from material collected by Mr. Champion at Volcan de Chiriqui, Panama, at an elevation of 2,000 to 4,000 feet. It is represented in the National Museum Collection by two specimens, which are probably paratypes, received from F. D. Godman and labeled, "Volcan de Chiriqui, 25–4000 ft. Champion."

PACHYSCHELUS PANAMENSIS, new species.

Male.—Broadly cuneiform, considerably longer than wide, strongly narrowed posteriorly; shining, nearly glabrous; head and sides of pronotum bright aeneous; scutellum and disk of pronotum piceous, with a feebly aeneous reflection; elytra piceous, with a strong bluish-green and violaceous tinge; beneath piceous.

Head strongly convex, feebly longitudinally grooved from vertex to epistoma; surface sparsely, obsoletely punctate, and finely granulated, the granulation dense and as prominent as the punctation on the front, but becoming smoother on the occiput. Pronotum moderately convex, three times as wide as long at the middle, much narrower in front than behind, widest at base; sides strongly obliquely arcuate from base to apical angles, the edge rather strongly margined and the apical angles rectangular; anterior margin rather deeply, arcuately emarginate; base nearly truncate, abruptly emarginate at elytral lobes; hind angles acute, scarcely projecting beyond the humeral angles of the elytra and fitting closely to them; surface sparsely punctate and densely granulated, the granulation much denser at the sides, clothed with a few short, very inconspicuous hairs. Scutellum finely, obsoletely punctate, and glabrous, the anterior angles acute. Elytra as wide as pronotum at base, slightly wider at at basal fourth; humeral angles obtusely rounded; sides feebly rounded to near the middle, then obliquely attenuate to the tips, which are conjointly, rather narrowly rounded, the lateral margin rather strongly serrate, and when viewed from the side is nearly straight, except for a slight sinuation for the insertion of the posterior femora; each elytron with rather deep, narrow depression between the humerus and elytral margin, extending along the margin from the humeral angles to a much broader depression behind the humerus, with only a trace of a basal depression; surface rather densely and coarsely punctate, the intervals nearly smooth on disk, becoming finely granulated and somewhat rugose at the sides and humeral region, and with a few very short, inconspicuous hairs. Abdomen beneath strongly convex, sparsely and obsoletely punctate, the punctures very shallow and open on the one side, sparsely clothed with short, inconspicuous, cinereous hairs; intervals finely and densely reticulate; last segment rather acutely rounded at the apex, with the margin flattened, the portion in front of the marginal groove acutely angulated, with the tip very acute. Elytral epipleura narrow. Metasternum more coarsely punctured than the abdomen, and rather deeply, rectangularly emarginate in front. Prosternum feebly, arcuately emarginate anteriorly; prosternal process about three times as wide as the coxal cavities, sides slightly expanded behind coxae, truncate at the apex with the angles broadly rounded; episternum short, flat, and triangular. Prothoracic epipleura wide and nearly flat, with a deep, narrow groove behind the antennal groove; lateral margin rectangular; antennal groove deep, following the suture between the episternum and epipleura, extending into the latter to the tibial groove and parallel to it.

Female.—Differs from the male in having the head and pronotum of a uniform piceous color, with a slight aeneous reflection, and the last abdominal segment narrow and strongly produced at the apex, deeply, narrowly and arcuately emarginate at the middle, with a very strong tooth on each side of it, next to which is a less strong and slightly shorter tooth, and on the outside a very small acute tooth at a lower level; the ventral surface with a broad, obsolete median depression.

Length, 2.25 mm.; width, 1.4 mm.

Type locality.—Paraiso, Canal Zone, Panama.

Other localities.—Panama City, Panama.

Type, allotype, and *paratypes.*—Cat. No. 25109, U.S.N.M.

Described from 16 specimens, 8 males and 8 females, 14 of which were collected by E. A. Schwarz, at Paraiso, Canal Zone, Panama, on March 20 and April 2, 1911; and a male and female taken by the same collector at Panama City, Panama, March 23, 1911.

PACHYSCHELUS DUBIUS Waterhouse.

Pachyschelus dubius WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 143, pl. 8, fig. 6.

This species was described from material collected by Mr. Champion at Teleman in Vera Paz, Guatemala; and Volcan de Chiriqui, Panama, at an altitude of 2,000 to 4,000 feet. It is not represented in the National Museum Collection, and the species has been placed in the key entirely upon the characters given in the original description.

PACHYSCHELUS CYANELLUS (Castelnau and Gory).

Brachys cyanella CASTELNAU and GORY, Mon. Bupr., vol. 2, Brachys, 1839, pp. 8–9, pl. 2, fig. 12.

This species was described from Colombia, South America. There are two males in the National Museum Collection which agree fairly well with the short description given for this species, both of which were collected at Paraiso, Canal Zone, Panama, January 28 and April 18, 1911, by E. A. Schwarz.

PACHYSCHELUS DIVERSUS Waterhouse.

Pachyschelus diversus WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 143, pl. 7, fig. 16.

The type locality of this species is Chiacam in Vera Paz, Guatemala, and was described from material collected by Mr. Champion. No specimens have been examined, and the characters given in the original description have been used as the basis for its position in the key.

PACHYSCHELUS SOLITARIUS Kerremans.

Pachyschelus solitarius KERREMANS, Ann. Soc. Ent. France, vol. 63, 1894, p. 421.

This species was described from material collected in the refuse of tobacco imported into Paris, France, from Mexico. The species is unknown to the writer, and has been placed in the key entirely upon the characters given in the original description.

PACHYSCHELUS THORACICUS Waterhouse.

Pachyschelus thoracicus WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, pp. 139–140.

Described from material collected by Mr. Champion at Capetillo, and Chiacam in Vera Paz, Guatemala. The species is not represented in the National Museum Collection, and it is placed in the key solely upon the characters given in the original description.

PACHYSCHELUS INCERTUS Waterhouse.

Pachyschelus incertus Waterhouse, Biol. Centra.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 142, pl. 8, fig. 4.

The type locality for this species is Taboga Island, Panama, and it was described from material collected by Mr. Champion. The type, which is in the British Museum, has not been examined, and the species has been given its position in the key solely upon the characters given in the original description.

PACHYSCHELUS FAMILIARIS Waterhouse.

Pachyschelus familiaris Waterhouse, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, pp. 141–142, pl. 8, fig. 9.

This species was described from material collected by H. H. Smith at Teapa in Tabasco, Mexico. There are four specimens in the National Museum Collection which agree very well with the description of this species, although they were collected in Panama. Two of these specimens were collected at Paraiso, Canal Zone, Panama, January 26 and March 26, 1911, by E. A. Schwarz; and the other two examples collected by A. H. Jennings, one at Paraiso, Canal Zone, Panama, and the other at Panama City, Canal Zone, Panama, during 1911.

PACHYSCHELUS COMMUNIS Waterhouse.

Pachyschelus communis Waterhouse, Biol. Centr.-Amer. Coleopt., vol.3, pt. 1, 1889, p. 141, pl. 8, fig. 3.

The type locality for this species is Taboga Island, Panama, and was described from material collected by Mr. Champion. It is represented in the National Museum Collection by six specimens, which are probably paratypes, received from F. D. Godman and labeled "Taboga Isl., Panama, Champion."

PACHYSCHELUS OCTODENTATUS Waterhouse.

Pachyschelus octodentatus Waterhouse, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 142, pl. 8, fig. 5.

This species was described from material collected by Mr. Champion at Bugaba and David, Panama. It is represented in the National Museum Collection by a unique female collected at Ancon, Canal Zone, Panama, May 5, 1911, by E. A. Schwarz.

PACHYSCHELUS SECEDENS Waterhouse.

Pachyschelus secedens Waterhouse, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 145, pl. 8 fig. 2.

Described from material collected by Höge at Tupataro in Guanajuata, Mexico. It is also reported by Waterhouse from Cordoba and northern Sonora, Mexico. It is represented in the National Museum Collection by a female collected at Cordoba, Vera Cruz, Mexico, April 12, 1908, by Frederick Knab, and a male collected at Finca Trece Aguas, Alta Vera Paz, Guatemala, at an altitude of 900 feet, April 9, 1906, by Schwarz and Barber. The specimen from Guatemala has the pronotum more widely margined with a lighter shade of green than the female from Mexico.

Genus BRACHYS Solier.

Brachys SOLIER, Ann. Soc. Ent. France, ser. 1, vol. 2, 1833, pp. 312–313.

About 100 species have been described in this genus and their distribution is confined to the Western Hemisphere. Of this large number of species, 9 have been described from the United States, 13 from Mexico and Central America, and the remainder from South America. The species of this genus attain their highest development in the tropical parts of South America.

Brachys chapuisi described by Dugès from Mexico[6] belongs to the genus *Pachyschelus.*

The following species described from Mexico and Central America have been omitted from the key, as it has been impossible to correlate the characters given in the original descriptions with those used in the key, and the writer has been unable to examine any specimens of these species: *hexagonalis* Dugès, from Mexico; *scapulosus* Chevrolat, from Mexico; *suavis*, *taciturnus*, and *debilis*, all described by Kerremans, from Guatemala.

KEY TO THE SPECIES.

1. Elytra without lateral carina.. 2
   Elytra with lateral carina.. 3
2. Above unicolored, aureous with indistinct pubescent spaces... **fulgidus** Fisher.
   Above bicolored; head and pronotum cupreous; elytra bluish-green, with distinct pubescent spaces.............................. **simplex** Waterhouse.
3. Lateral carina on elytra interrupted at middle......... **dimidiatus** Waterhouse.
   Lateral carina on elytra not interrupted at middle.......................... 4
4. Elytra with tufts of hair.............................. **floccosus** Mannerheim.
   Elytra without tufts of hair.. 5
5. Pronotum without lateral carina.. 6
   Pronotum with short lateral carina.. 7
6. Sides of pronotum broadly flattened......................... **bellus** Fisher.
   Sides of pronotum not broadly flattened.................. **cuprifrons** Fisher.
7. Epistoma with a transverse carina.. 8
   Epistoma without transverse carina.. 11
8. Elytra brown, with a strong aeneous tinge..................... **pilosus** Fisher.
   Elytra piceous, with a violaceous, cupreous, or greenish tinge............... 9
9. Elytra piceous, with a greenish tinge, and with transverse pubescent spaces.
   nigroviridis Fisher.
   Elytra piceous, with a violaceous or cupreous tinge....................... 10
10. Pubescence on elytra forming transverse designs.... **anthrenoides** Waterhouse.
    Pubescence on elytra not forming transverse designs..........**confusus** Fisher.

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[6] La Naturaleza, ser. 2, vol. 2, 1891, p. 36, pl. 2, fig. 63.

11. Elytra cyaneous, with a violaceous tinge 12
    Elytra piceous, with violaceous, cupreous, or greenish tinge 13
12. Median fascia on elytra distinct, irregular, and composed of fulvous hair, bordered in front and behind with whitish ones; apex of abdomen with a series of obsolete teeth .... **distinctus** Waterhouse.
    Median fascia rather indistinct, transverse, and composed of fine whitish hair; apex of abdomen with distinct teeth .... **laetus** Waterhouse.
13. Elytra piceous, with a strong violaceous tinge; each elytron with two cinereous pubescent areas, inclosing a round dark space, one near the middle close to the lateral carina, the other near the apex .... **elegans** Fisher.
    Elytra piceous, with cupreous or greenish tinge 14
14. Elytron with the pubescent space at apex inclosing a round dark area. **ornatus** Fisher.
    Elytron with the pubescent space at apex not inclosing a round dark area. **pulverosus** Waterhouse.

BRACHYS FULGIDUS, new species.

Female.—Broadly ovate, slightly longer than wide, broadly rounded in front, slightly narrower behind than in front, strongly shining and nearly glabrous; head bluish-green; pronotum, scutellum, and elytra aureous, with a strong cupreous tinge, the pronotum with the anterior angles greenish; beneath piceous, with a strong greenish reflection.

Head nearly flat, longitudinally grooved from occiput to epistoma, the groove becoming deeper and broader behind the epistoma, and with a broad, shallow depression on the occiput; surface glabrous and irregularly punctate, the punctures large, deep, widely separated, and becoming more obsolete on the occiput; intervals densely, obsoletely granulated, and finely reticulate, the reticulation irregular and widely separated; epistoma wide between the antennal cavities, surface depressed, with a feeble transverse carina in front of the depressed area. Pronotum strongly flattened, about three times as wide as long at middle, distinctly narrower in front than behind, widest at base; sides arcuately attenuate from base to anterior angles; anterior margin arcuately emarginate for the insertion of the head; base transversely truncate to the elytral lobe, then turning obliquely backward to the scutellum, in front of which it is nearly truncate; posterior angles nearly rectangular and feebly rounded; surface glabrous and uneven, with an obsolete depression extending obliquely backward from the anterior angles to the median part, sparsely and irregularly punctate, the punctures very shallow and more numerous at the sides; intervals obsoletely granulated, and with a few very fine punctures. Scutellum nearly smooth, broadly triangular, anterior margin truncate. Elytra scarcely as wide as pronotum at base; humeral angles broadly rounded; sides parallel to near middle (feebly sinuate at basal fourth), then arcuately attenuate to the tips, which are conjointly broadly rounded, the lateral margins feebly serrate toward the apex; each elytron with a rather deep, broad depression at the base, and the disk rather uneven and without lateral carina, sparsely and irregularly punctate, with a very small spot of rather long, recumbent, cinereous pubescence at the middle, close to the suture; intervals nearly smooth. Abdomen beneath rather flat, sparsely punctate, the punctures large, shallow and open on the one side, and from each one arises a short, recumbent, cinereous hair; intervals densely and finely granulated; last segment broadly rounded at the apex, with the margin entire.

Length, 3.75 mm.; width, 2.3 mm.

Type locality.—Panama City, Panama.

Type.—Cat. No. 25110, U.S.N.M.

Described from a unique female reared from larvae mining in the leaves of an unknown plant, the leaves of which are similar to that of the rubber plant (*Ficus elastica*), and collected by August Busck.

This species is distinguished from nearly all the other species of this genus by being much depressed, nearly glabrous, and the elytra without lateral carina.

The eggs are laid on the upper surface of the leaves, and as many as 12 eggs having been layed on a single leaf. The eggs are brown in color, strongly flattened, and oval, measuring 2.2 by 1.75 millimeters. The larva on hatching bores directly into the leaf from the underside of the egg, and mines under the upper epidermis of the leaf. The mines are usually elongate, very irregular, and measuring about 12 centimeters in length. At first the mines are only 2 millimeters wide, but are gradually broadened until they are about 15 millimeters in width. The larva on reaching maturity pupates in the leaf without making any cell.

BRACHYS SIMPLEX Waterhouse.

Brachys simplex Waterhouse, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, pp. 134-135, pl. 7, fig. 14.

This species was described from San Geronimo, Guatemala, and the type, which is in the British Museum, has not been examined. It is the only species known from Mexico and Central America, with the exception of *fulgidus* Fisher, which has no lateral carina on the elytra.

BRACHYS DIMIDIATUS Waterhouse.

Brachys dimidiatus Waterhouse, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 134.

The type locality of this species is Cerro Zunil, Guatemala, at an elevation of 4,000 feet. The type is in the British Museum and has not been examined. This is the only known species from the region covered by this paper which has the lateral carina interrupted at the middle, and is intermediate between the species which have the lateral carina on the elytra entire and those without any trace of a carina. No specimens have been examined of this species and it is placed in the key upon the characters given in the original description.

BRACHYS FLOCCOSUS Mannerheim.

Brachys floccosa MANNERHEIM, Bull. Soc. Imp. Nat. Moscow, vol. 10, No. 8, 1837, pp. 118–119.

This species has been described from Oaxaca, Mexico. It has been reported also from Guatemala by Waterhouse,[7] and is represented in the National Museum Collection by 11 specimens collected at Rincon Antonio, Oaxaca, Mexico, by Frederick Knab.

It is easily distinguished from all the other known species found in the region covered by the present paper by the distinct tufts of hair on the posterior part of the elytra. The males have the last abdominal segment broadly rounded, and armed with a series of obsolete teeth, and the head rather densely clothed with either golden or pale yellow pubescence, with two glabrous spaces on the vertex. Females have the last abdominal segment subtruncate and armed with a series of short distinct teeth, which are rather broadly rounded at tips, equal in length, and of equal distance apart; head not as densely pubescent as in the male, the pubescence composed of cinereous and fulvous hairs intermixed, with four glabrous spaces, two of which are on the front and two on the vertex.

BRACHYS BELLUS, new species.

Male.—Broadly cuneiform, distinctly longer than wide, broadly rounded in front, slightly narrower behind than in front, shining, and with distinct pubescent fasciae on the elytra; head and pronotum aeneous, with a slight cupreous tinge; scutellum piceous; elytra cyaneous, the humeral areas and the space behind the first transverse pubescent fascia strongly violaceous, and the apex aeneo-viridis; beneath piceous.

Head feebly convex and transversely flattened behind the epistoma, with a rather deep groove extending from the occiput to a broad, deep depression on the front, the groove becoming obsolete on the flattened area behind the epistoma; surface densely punctured behind the epistoma, the punctures becoming more widely separated on the vertex and occiput, and nearly obsolete in the median depression, clothed with rather long fulvous pubescence, the pubescence dense and erect behind the epistoma, becoming sparser and recumbent posteriorly, and nearly glabrous in the median depression; intervals finely, densely, and obsoletely granulated; epistoma rather wide between the antennal cavities, surface flat and not transversely carinate in front. Pronotum moderately convex, two times as wide as long at middle, slightly narrower in front than behind, widest at apical third; sides broadly rounded to middle, then parallel to the posterior angles, which are rectangular; anterior margin arcuately emarginate for the insertion of the head; base transversely truncate to middle

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[7] Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 131.

of elytron, then turning obliquely backward to the scutellum, in front of which it is arcuately emarginate; surface broadly flattened at the sides, the depression extending obliquely from the anterior angles to the base at middle of the elytron, and then transversely along the base, causing the anterior median part of the disk to be regularly convex, without lateral carina, finely and sparsely punctate on the disk, with large, round, shallow punctures in the flattened areas, sparsely clothed with long, recumbent, fulvous pubescence, with two small spots of denser pubescence at the base, close to the scutellum; intervals obsoletely granulated. Scutellum obsoletely granulated, broadly triangular, anterior margin rounded. Elytra slightly wider than pronotum at base, widest at basal sixth; humeral angles broadly rounded; sides rounded to basal fourth, then nearly parallel to the middle, and then obliquely attenuate to the tips, which are conjointly rounded, with the lateral margins entire; humeri prominent. Each elytron with a deep broad depression at the base, and a deeper one behind the humerus between the lateral carina and lateral margin, and with a distinct sinuate lateral carina extending from the humeral angle to the apical fourth; with a fine line of blackish hairs (cinereous at the base) extending from the base to the pubescent fascia at middle; the basal half is rather densely clothed with long semierect blackish hairs, with a few cinereous ones behind the scutellum; at the middle there is a well-marked, moderately broad fascia of long semierect cinereous hairs, which extends from the suture to the lateral margin, and behind this fascia is a broader fascia of blackish hairs, similar to those on the basal half; the apical fourth is rather densely clothed with cinereous hairs similar to those on the median fascia; surface finely and densely punctate; the punctures coarser and more widely separated on the sides and humeral region, and finely granulated; intervals nearly smooth. Abdomen beneath moderately convex, sparsely punctate, the punctures large, nearly obsolete, and open on the one side, from each one arises a short recumbent cinereous hair; intervals finely and densely granulated; last segment broadly rounded at the apex, with the margin entire.

Female.—Differs from the male in having the pubescence on the side of pronotum cinereous, humeral regions of elytra not quite so violaceous and more rugose, head cupreous, sparsely pubescent on the occiput, becoming nearly glabrous anteriorly, and without the dense pubescence behind the epistoma.

Length, 2.6–3.4 mm.; width, 1.25–1.7 mm.

Type locality.—Porto Bello, Panama.

Other localities.—Paraiso and Tavernilla, Canal Zone, Panama; Trinidad River and Buena Ventura, Panama.

Type, allotype, and *paratypes.*—Cat. No. 25111, U.S.N.M.

Described from 15 specimens, 5 males and 10 females.

The type and allotype were collected by E. A. Schwarz at the type locality February 16 and 25, 1911. Five paratypes collected by E. A. Schwarz at Paraiso, Canal Zone, Panama, between January 19 and April 11, 1911; one collected by A. H. Jennings at Paraiso, Canal Zone, Panama, March 28, 1911. August Busck also collected the following paratypes: Four at Paraiso, during January and February, 1911, one at Tavernilla, April 27, 1907, all in the Canal Zone, Panama; one specimen at Buena Ventura, March 10, 1911, and another specimen at Trinidad River, May 4, 1911, both in Panama.

BRACHYS CUPRIFRONS, new species.

Female.—Broadly cuneiform, distinctly longer than wide, broadly rounded in front, slightly narrower behind than in front, moderately shining and sparsely pubescent; head cupreous, becoming reddish on the occiput; pronotum bluish-green, with the sides and anterior margin reddish; scutellum and elytra bluish-green, the latter becoming strongly cyaneous at the humeral areas; beneath piceous.

Head feebly convex, longitudinally grooved from occiput to epistoma, the groove rather broad and deep on the front, becoming obsolete on the occiput; surface with a few shallow, irregular punctures, the punctures more numerous behind the epistoma, but becoming obsolete toward the occiput, very sparsely clothed with short, inconspicuous, recumbent, cinereous hairs; intervals rather densely granulated behind the epistoma, but becoming smoother posteriorly; epistoma wide between the antennal cavities, surface concave and not transversely carinate in front. Pronotum strongly convex, three times as wide as long at the middle, distinctly narrower in front than behind, widest at base; sides arcuately attenuate from base to anterior angles; anterior margin arcuately emarginate, with a broad, obsolete median lobe; base transversely truncate to the elytral lobe, then turning obliquely backward to the scutellum, in front of which it is arcuately emarginate; posterior angles nearly rectangular; surface feebly depressed along base at middle, and with an obsolete depression extending obliquely backward from the anterior angles to the median part, without a lateral carina, finely, irregularly, and sparsely punctate, and very sparsely clothed with rather long, recumbent, cinereous hairs; intervals finely and densely granulated. Scutellum nearly smooth, broadly triangular, sides and anterior margin feebly rounded. Elytra slightly wider than pronotum at base, widest at basal fourth; humeral angles obtusely angulated; sides feebly rounded to middle, then strongly, obliquely attenuate to the tips, which are conjointly, broadly rounded, the lateral margins obsoletely serrate toward the apex; humeri prominent; each elytron with a deep, rather broad depression at the base, a distinct lateral carina, which is strongly sinuate behind the humerus, and extending from the humeral angle to near the apex, and with two obsolete costae on the disk; surface finely and rather densely punctate, with a few larger punctures toward the base and sides, the basal half is sparsely clothed with long, recumbent, blackish hairs (with a few cinereous ones intermixed); at the middle there is a broad irregular fascia of cinereous hairs, and a similar fascia at the apical fourth; between the two fasciae and the apical fifth the surface is rather densely clothed with long, recumbent, black hairs; intervals smooth. Abdomen beneath strongly convex, sparsely punctate, the punctures large, obsolete, and open on the one side, sparsely clothed with rather long, recumbent cinereous hairs; intervals finely and densely granulated; last segment broadly rounded at the apex, with a series of short, round teeth along the margin.

Length, 4.25 mm.; width, 2.3 mm.

Type locality.—Trinidad River, Panama.

Type.—Cat. No. 25112, U.S.N.M.

Described from a unique female collected by August Busck March 21, 1912.

BRACHYS PILOSUS, new species.

Male.—Broadly cuneiform, distinctly longer than wide, broadly rounded in front, slightly narrower behind than in front, moderately shining and pubescent, uniformly brown, with a strong aeneous tinge; beneath piceous.

Head transversely flattened behind the epistoma, with two smooth feeble gibbosities on the vertex, rather broadly, longitudinally grooved from occiput to the flattened area on front, the groove rather deep on the vertex, but becoming nearly obsolete posteriorly; surface coarsely and densely punctured on the flattened area behind the epistoma, the punctures finer and more widely separated on the occiput, and becoming obsolete on the gibbosities, clothed with rather long pale-yellow pubescence, the pubescence dense and erect behind the epistoma, becoming sparser and recumbent posteriorly, and obsolete on the gibbosities; intervals finely, densely, and obsoletely granulated; epistoma narrow between the antennal cavities, surface flat, with a feebly transverse carina near the anterior margin. Pronotum moderately convex, about two times as wide as long at middle, distinctly narrower in front than behind, widest at base; sides arcuately attenuate from base to anterior angles; anterior margin nearly truncate; base transversely truncate to middle of elytron, then turning obliquely backward to the scutellum, in front of which it is feebly, arcuately emarginate; posterior angles nearly rectangular; surface broadly flattened at the sides, the depression extending obliquely from the anterior angles to the base at middle of the elytron, and then transversely along the base, causing the anterior median part of the disk to be regularly convex; there is a distinct straight carina on each side in the flattened area, which does not reach the base, nor anterior margin, finely and sparsely punctate on the disk, with large, round, shallow punctures in the flattened areas, sparsely clothed with long, recumbent, pale-yellow hairs (with a few fulvous ones intermixed); intervals obsoletely granulated. Scutellum finely granulated, triangular, anterior margin rounded. Elytra distinctly narrower than the pronotum at base; humeral angles broadly rounded; sides nearly parallel to the middle (feebly sinuate at the basal fourth), then obliquely attenuate to the tips, which are conjointly broadly rounded, with the lateral margins entire; humeri moderately prominent. Each elytron with a broad, deep depression at the base, and a deeper one behind the humerus between the lateral carina and lateral margin, and with a distinct sinuate lateral carina extending from the humeral angle to near the apex; with two fine lines of fulvous hairs extending from the base to near the middle; the basal two-thirds is irregularly and sparsely clothed with rather long, recumbent, pale-yellow hairs (with a few fulvous ones intermixed), leaving a small bare space at the suture, just in front of the middle; behind this there is a rather broad fascia of semierect fulvous hairs, with the margins very irregular; apical fourth sparsely clothed with rather long, recumbent, pale-yellow hairs, inclosing three small, round spots of fulvous hairs, two placed transversely at the middle, and the other one at the apex; surface finely and rather densely punctate, with a few stelliform punctures along the lateral carina; intervals nearly smooth. Abdomen beneath moderately convex, sparsely punctate, the punctures large, shallow, and open on the one side, and from each puncture arises a rather long, recumbent, cinereous hair; intervals finely and densely granulated; last segment broadly rounded at apex, with the margin entire.

Length, 2.75 mm.; width, 1.4 mm.

Type locality.—Ancon, Canal Zone, Panama.

Type.—Cat. No. 25113, U.S.N.M.

Described from a unique male collected by E. A. Schwarz May 5, 1911.

BRACHYS NIGROVIRIDIS, new species.

Male.—Broadly cuneiform, distinctly longer than wide, broadly rounded in front, narrower behind than in front, moderately shining, and sparsely pubescent, uniformly piceous above, with a slight greenish tinge on the elytra; beneath piceous.

Head feebly convex, broadly and deeply, longitudinally grooved from occiput to epistoma, the groove becoming more shallow on the occiput; surface densely and coarsely granulated, with a few inconspicuous punctures intermixed, sparsely clothed with short, recumbent, cinereous hairs behind the epistoma, along the eyes, and on the occiput; epistoma narrow between the antennal cavities, surface longitudinally concave, and with a strong, transverse carina near the anterior margin. Pronotum moderately convex, about two and one-half times as wide as long at middle, distinctly narrower in front than behind, widest at the base; sides obliquely attenuate from base to anterior angles; anterior margin nearly truncate; base transversely truncate to middle of elytron, then turning obliquely backward to the scutellum, in front of which it is arcuately emarginate; posterior angles nearly rectangular; surface broadly depressed at the sides, the depression extending obliquely from the anterior angles to the base at middle of the elytron, then transversely along the base, causing the anterior median part of the disk to be regularly convex; there is a distinct, short, straight carina on each side in the depressed area, which does not reach the base nor anterior margin, finely and sparsely punctate on the disk with large, round, shallow punctures in the depressed areas, sparsely clothed with rather long, recumbent, cinereous hairs; intervals finely and densely granulated. Scutellum finely granulated, broadly triangular, anterior margin rounded. Elytra slightly narrower than the pronotum at base; humeral angles obtusely angulated; sides nearly parallel to the middle (feebly sinuate at the basal fourth), then obliquely attenuate to the tips, which are separately rounded, with the lateral margins entire; humeri moderately prominent. Each elytron with a broad, rather deep depression at the base, and a shallow one behind the humerus between the lateral carina and the lateral margin, and with a distinct lateral carina extending from the humeral angle to near the apex; with four fine lines of dark-brown hairs, extending from the base to near the apex, one along the suture, two on the disk, and the fourth along the lateral carina; the basal third nearly glabrous, with a few cinereous and fulvous hairs intermixed; just behind the middle there is a narrow fascia of rather long, cinereous hairs (with a few yellowish ones intermixed), and with a small spot of cinereous pubescence between the third and fourth longitudinal lines of brownish hairs, which is connected posteriorly to the median fascia; behind this fascia is an equally wide transverse glabrous space, and at the apical fourth a triangular spot of cinereous pubescence, which extends to the lateral carina; apex with a few short, recumbent, cinereous hairs; surface finely and rather densely punctured in the pubescent spaces, with a series of stelliform punctures on each side of the longitudinal lines of hairs; intervals smooth. Abdomen beneath moderately convex, sparsely punctate, the punctures large, shallow, and open on the one side, and from each puncture arises a rather long, recumbent, cinereous hair; intervals finely and densely granulated; last segment narrowly rounded posteriorly, with the margin feebly emarginate at apex, and very finely dentate.

Length, 2.9 mm.; width, 1.4 mm.

Type locality.—Paraiso, Canal Zone, Panama.

Type.—Cat. No. 25114, U.S.N.M.

Described from a single male collected by E. A. Schwarz March 16, 1911.

BRACHYS ANTHRENOIDES Waterhouse.

Brachys anthrenoides WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 132.

The species was described from Bugaba, Volcan de Chiriqui, 3,000 to 4,000 feet, and Taboga Island, all from Panama, without designating any definite type locality. It is represented in the National Museum Collection by four specimens, which are probably paratypes, received from F. D. Godman and labeled "Taboga Isl., Panama. Champion." Besides these four specimens, the National Collection also contains the following: Six specimens collected at Paraiso, Canal Zone, Panama, between January 19 and April 6, 1911, by E. A. Schwarz; another specimen collected in Old Panama, January 31, 1911, by the same collector; two collected at Paraiso, Canal Zone, Panama, April 10 and March 28, 1911, by A. H. Jennings; and two other specimens collected on Taboga Island, Panama, February 23, 1911, by August Busck.

BRACHYS CONFUSUS, new species.

Male.—Broadly cuneiform, distinctly longer than wide, broadly rounded in front, narrower behind than in front, subopaque and rather densely pubescent; head aeneo-viridis in front; pronotum, scutellum, and elytra piceous, with a slight bluish and violaceous tinge on the top, becoming strongly cupreous at the sides; beneath piceous, with a strong aeneous reflection.

Head nearly flat, broadly, longitudinally grooved from epistoma to occiput, the groove rather deep behind the epistoma, but becoming obsolete on the occiput; surface finely, densely granulated and finely punctate, clothed with long, recumbent, cinereous pubescence, which is much denser behind the epistoma; epistoma narrow between the antennal cavities, surface longitudinally concave, with a strong transverse carina near the anterior margin. Pronotum moderately convex, two and one-half times as wide as long at middle, distinctly narrower in front than behind, widest at base; sides arcuately attenuate from base to anterior angles; anterior margin nearly truncate; base transversely truncate to middle of elytron, then turning obliquely backward to the scutellum, in front of which it is arcuately emarginate; posterior angles nearly rectangular; surface broadly depressed at the sides, the depression extending obliquely from the anterior angles to the base at middle of elytron, then transversely along the base, causing the anterior median part of the disk to be regularly convex; there is a distinct sinuate carina on each side in the depressed area, which does not quite reach the base nor anterior margin, finely and sparsely punctate on the disk, with large, round, shallow punctures in the depressed areas, rather densely clothed with long, recumbent, pale-yellow hairs, with two small spots of denser pubescence at the base, close to the scutellum; intervals obsoletely granulated. Scutellum nearly smooth, broadly triangular, anterior margin rounded. Elytra as wide as pronotum at base; humeral angles obtusely angulated; sides nearly parallel to the middle (feebly sinuate at the basal fourth), then obliquely attenuate to the tips, which are conjointly broadly rounded, with the lateral margins entire; humeri moderately prominent. Each elytron with a broad, shallow depression at the base, and a similar shallow one behind the humerus between the lateral carina and lateral margin, and with a distinct lateral carina, which is strongly sinuate at the humerus and extending from the humeral angle to near the apex; surface very uneven on the basal half, becoming smoother posteriorly, with a fine line of pale-yellow hairs extending from the base to the middle, sparsely clothed with long, recumbent, pale-yellow pubescence, but not forming any distinct markings, there are two obsolete spots of erect fulvous hairs on the apical fourth, close to the suture, sparsely and rather finely punctate, the punctures coarser toward the base; intervals finely and densely granulated. Abdomen beneath rather densely punctate, the punctures large, shallow, open on the one side, and from each puncture arises a rather long, recumbent, cinereous hair; intervals finely and densely granulated; last segment broadly rounded at the apex, with the margin very finely dentate.

Length, 2.9 mm.; width, 1.4 mm.

Type locality.—Trece Aguas, Alta Vera Paz, Guatemala.

Type.—Cat. No. 25115, U.S.N.M.

Described from a unique male collected by E. A. Schwarz and H. S. Barber May 4, 1906.

BRACHYS DISTINCTUS Waterhouse.

Brachys distinctus WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, pp. 132-133.

This species was described from San Isidro, Guatemala, and the type, which is in the British Museum, has not been examined. The species has been placed in the key solely upon the characters given in the original description.

BRACHYS LAETUS Waterhouse.

Brachys laetus WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 134.

This species was described from specimens collected at Bugaba and Volcan de Chiriqui, Panama. The type is in the British Museum and has not been examined. In the National Museum Collection there is a single specimen collected at Paraiso, Canal Zone, Panama, March 20, 1911, by E. A. Schwarz, which agrees with the description given for this species with the exception that the lateral carina is not quite as close to the margin, and the median fascia is not very distinct. The specimen has a strong violaceous tinge on the elytra, especially along the sides behind the middle, in which respect it agrees with the specimen described from Bugaba, but the abdominal segment is subtruncate at the apex, and armed with series of distinct, short teeth, and is probably a female.

BRACHYS ELEGANS, new species.

Male.—Elongate, distinctly longer than wide, broadly rounded in front, nearly as wide behind as in front, strongly shining, and the elytra ornated with distinct pubescent designs; head aeneous in front, becoming violaceous on the occiput; pronotum, scutellum, and elytra piceous and strongly violaceous; beneath piceous.

Head nearly flat, broadly, longitudinally grooved from occiput to epistoma, the groove rather shallow and becoming obsolete on the occiput; surface finely and rather densely punctured on the front, the punctures becoming more widely separated posteriorly, densely clothed with long, semierect, golden pubescence on the front, the pubescence sparser and more recumbent toward the occiput; intervals smooth; epistoma rather wide between the antennal cavities, flat, and not transversely carinate in front. Pronotum moderately convex, two and one-half times as wide as long at middle, distinctly narrower in front than behind, widest at base; sides obliquely attenuate from base to anterior angles; anterior margin feebly, arcuately emarginate; base transversely truncate to middle of elytron, then turning obliquely backward to the scutellum, in front of which it is arcuately emarginate; posterior angles rather acute and projecting slightly beyond the elytra; surface broadly depressed at the sides, the depression extending obliquely from the anterior angles to the base at middle of elytron, then transversely along the base, causing the anterior median part of the disk to be regularly convex; there is a distinct straight carina on each side in the depressed area, which does not reach the base nor anterior margin, finely and sparsely punctate on the disk, with large, round, shallow punctures in the depressed areas, rather sparsely clothed with long, recumbent, cinereous hairs, with two small spots of denser pubescence at the base close to the scutellum; intervals obsoletely granulated. Scutellum obsoletely granulated, triangular, anterior margin rounded. Elytra nearly as wide as pronotum at base; humeral angles obtusely angulated; sides nearly parallel to the middle (strongly sinuate at basal fourth), then arcuately attenuate to the tips, which are conjointly broadly rounded, with the lateral margins entire; humeri prominent. Each elytron with a broad, shallow depression at the base, and a deeper one behind the humerus between the lateral carina and lateral margin, and with a distinct lateral carina, which is sinuate and strongly elevated at the humerus, and extending from the humeral angle to near the apex; with two fine lines of dark-brown hairs (the external one more obsolete) extending from the base to the middle; the basal third is sparsely clothed with recumbent, blackish hairs, the space near the scutellum (between the suture and pubescent line) is clothed with cinereous hairs and bordered behind by fulvous hairs; at a short distance from the base, between the first and second pubescent lines, there is a small spot of cinereous pubescence; at the middle there is a well-marked, moderately broad fascia of recumbent, cinereous hairs, inclosing a small, round, dark spot situated between the second pubescent line and the lateral carina; the fascia has the margins irregular and extends from the first pubescent line to the lateral margin; close to the suture and slightly posterior to the fascia is a small spot of fulvous hairs bordered posteriorly by cinereous hairs; behind the median fascia there is a broad, transverse space sparsely clothed with semierect, black hairs; and the apical fifth is clothed with recumbent, cinereous pubescence, inclosing a round, dark, spot; sparsely and rather finely punctate, with a series of coarser punctures on each side of the pubescent lines; intervals nearly smooth. Abdomen beneath rather densely punctate, the punctures large, shallow, open on the one side, and from each puncture arises a rather long, recumbent, cinereous hair; intervals smooth, becoming obsoletely granulated on the last segment, which is broadly rounded posteriorly and very finely dentate at the apex.

Length, 3.1 mm.; width, 1.6 mm.

Type locality.—Paraiso, Canal Zone, Panama.

Type.—Cat. No. 25116, U.S.N.M.

Described from a single male specimen collected by E. A. Schwarz February 11, 1911.

BRACHYS ORNATUS, new species.

Male.—Elongate, distinctly longer than wide, broadly rounded in front, slightly narrower behind than in front, moderately shining, and the elytra ornated with distinct transverse pubescent fasciae; head slightly aeneous in front, becoming slightly cupreous on the occiput; pronotum, scutellum, and elytra piceous, with a strong, cupreous and greenish reflection; beneath piceous, with a strong aeneous reflection.

Head nearly flat, broadly, longitudinally grooved from epistoma to occiput, the groove quite deep on the front and vertex, and becoming more obsolete near the epistoma and on the occiput; surface finely and rather densely punctate, the punctures becoming more widely separated posteriorly, rather sparsely clothed with long, recumbent, dark and light yellow hairs intermixed; intervals obsoletely granulated; epistoma rather wide between the antennal cavities, flat and not transversely carinate in front. Pronotum moderately convex, two times as wide as long at middle, distinctly narrower in front than behind, widest at base; sides obliquely attenuate from base to anterior angles; anterior margin nearly truncate; base transversely truncate to middle of elytron, then turning obliquely backward to the scutellum, in front of which it is arcuately emarginate; posterior angles rounded; surface broadly depressed at the sides, the depression extending obliquely from the anterior angles to the base at middle of elytron, then transversely along the base, causing the anterior median part of the disk to be regularly convex, there is a distinct straight carina on each side in the depressed area, which does not reach the base nor anterior margin, finely and sparsely punctate on the disk, with large, round, shallow punctures in the depressed areas, sparsely clothed with long, recumbent, cinereous hairs (with a few fulvous ones here and there) leaving two round, approximate bare spots on the disk, and with two small spots of denser pubescence at the base, close to the scutellum; intervals obsoletely granulated. Scutellum nearly smooth, broadly triangular, anterior margin rounded. Elytra nearly as wide as pronotum at base; humeral angles obtusely angulated; sides nearly parallel to the middle (strongly sinuate at basal fourth), then obliquely attenuate to the tips, which are conjointly broadly rounded, with the lateral margins entire; humeri prominent. Each elytron with a broad, shallow depression at the base, and a deeper one behind the humerus between the lateral carina and lateral margin, with a distinct lateral carina, which is sinuate and strongly elevated at the humerus, broadly depressed at basal third, and extending from the humeral angle to the apex, with four fine lines of fulvous hairs extending from the base to the middle, one along the suture, two on the disk, and the fourth along the lateral carina; basal half nearly glabrous, with a few fulvous hairs between the third pubescent line and the lateral margin and the space near the scutellum (between the suture and second pubescent line) sparsely clothed with fulvous pubescence; at a short distance behind the base, between the second and third pubescent lines, there is a small spot of cinereous hairs; at the middle there is a well-marked, moderately broad fascia of recumbent, cinereous pubescence, inclosing a small patch of fulvous hairs, and extending from the second to the fourth pubescent line; at the posterior margin of this fascia there are two small patches of cinereous hairs, one near the lateral margin and the other close to the suture; behind the median fascia there is a transverse space with a few recumbent, black hairs; the apex is covered with recumbent fulvous hairs, inclosing a small, round, dark space, and bordered above with cinereous hairs; finely and rather densely punctured on the pubescent spaces, with a series of stelliform punctures on each side of the pubescent lines; intervals nearly smooth. Abdomen beneath rather densely punctate, the punctures large, shallow, open on the one side, and from each puncture arises a rather long, recumbent, cinerous hair; intervals finely and densely granulated; last segment broadly rounded posteriorly, and very finely dentate at the apex.

Female.—Differs from the male in having the head more convex, more deeply grooved at middle, surface smoother and very sparsely pubescent, the pubescence nearly obsolete on the front, and the abdomen broader and not quite as attenuate posteriorly.

Length, 3–3.2 mm.; width, 1.4–1.5 mm.

Type locality.—Paraiso, Canal Zone, Panama.

Type, allotype, and *paratypes.*—Cat. No. 25117, U.S.N.M.

Described from 10 specimens, 5 males and 5 females, all of which were collected by E. A. Schwarz at the type locality between January 17 and May 12, 1911.

This species is closely allied to *Brachys distinctus* Waterhouse, described from Guatemala. It differs, however, from that species, by having the elytra piceous, with a cupreous, violaceous or greenish, reflection, and not cyaneous as in that species, and the arrangement and color of the pubescent markings on the elytra are different.

BRACHYS PULVEROSUS Waterhouse.

Brachys pulverosus WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 138.

This species was described from material collected at Jalapa, Mexico, by C. T. Höge.

It is represented in the National Museum Collection by a single example collected at Tampico, Mexico, December 25, 1909, by E. A. Schwarz. It agrees with the description for this species, with the exception that the two small spots near the scutellum are composed of fulvous hairs instead of white ones, as given in the original description.

Genus LIUS Deyrolle.

Lius H. DEYROLLE, Ann. Soc. Ent. Belg., vol. 8, 1864, p. 219.

Nearly 75 species have been described in this genus, the distribution of which is confined to the Western Hemisphere. Of this number of species only 6 have been previously described from Mexico and Central America, 1 from the Antilles, and the remainder of the species from South America, where this genus attains its highest development. All of the species of this genus are similar in form, somewhat triangular, and strongly attenuate posteriorly, but are rather variable in color.

KEY TO THE SPECIES.

1. Surface above unicolored.. 2
 Surface above bicolored.. 6
2. Epistoma very narrow; antennae nearly contiguous.......................... 3
 Epistoma transverse; antennae widely separated.......................... 4
3. Above uniformly piceous, with a slight purplish tinge.......**cuneiformis** Fisher.
 Above uniformly steel-blue with an iridescent reflection ....**timidus** Kerremans.
4. Color above uniformly blue..................................**ares** Saunders.
 Color above aeneous or cupreous 5
5. Color above aeneous.......................................**mexicanus** Fisher.
 Color above rufo-cupreous..................................**dissimilis** Waterhouse.
6. Pronotum piceous...**parvulus** Waterhouse.
 Pronotum aeneous or cupreous.. 7
7. Form elongate, more than two times as long as wide; pronotum aureo-aeneous; elytra varying from greenish-blue to rufo-cupreous, with a purplish tinge. **variabilis** Waterhouse.
 Form shorter, not two times as long as wide; pronotum cupreo-aeneous; elytra varying from cyaneous to greenish-blue, with a violaceous tinge............ 8
8. Head and pronotum finely and regularly punctured; elytra wider than pronotum. **amabilis** Kerremans.
 Head and pronotum rather coarsely, very sparsely and irregularly punctured; elytra not distinctly wider than pronotum ....**parvulus**, var. Waterhouse.

LIUS CUNEIFORMIS, new species.

Male.—Elongate, cuneiform, strongly convex, strongly attenuate posteriorly, shining, and uniformly piceous above, with a slight purplish tinge; beneath piceous, without any purplish reflection.

Head feebly convex, broadly and rather deeply depressed on the front, the depression becoming obsolete on the occiput, with a narrow, longitudinal groove extending from the epistoma to the vertex; front narrow, about as wide as the tranverse diameter of the eye; surface glabrous, very sparsely punctate, the punctures very shallow and obsolete; intervals densely and finely, but distinctly reticulate-striolate; eyes moderately convex; epistoma very narrow, the antennae nearly contiguous. Pronotum strongly convex, nearly two and one-half times as wide as long at base, distinctly narrower in front than behind, widest at base; sides when viewed from above are parallel at the base for a very short distance, then strongly, obliquely attenuate to the anterior angles; posterior angles nearly rectangular; anterior margin nearly truncate; base feebly sinuate to beyond the middle of the elytron, then turning obliquely backward to the scutellum, in front of which it is feebly, arcuately emarginate; surface without a median carina, sparsely punctate, the punctures very shallow and obsolete, and with a few short, recumbent, inconspicuous hairs; intervals very finely and obsoletely reticulate-striolate. Scutellum triangular; anterior margin arcuately rounded; surface nearly smooth. Elytra strongly convex, slightly wider than pronotum at base, widest at base; humeral angles obtusely angulated; sides strongly, arcuately attenuate to the tips, which are separately narrowly rounded, the lateral margins finely serrate; humeri rather prominent; each elytron with an obsolete basal depression, and a very feeble one behind the humeral angle; surface glabrous, sparsely, irregularly, and coarsely punctate, the punctures very shallow and obsolete; intervals smooth. Abdomen beneath sparsely and irregularly punctate, the punctures very shallow and obsolete, sparsely clothed with very short, recumbent, inconspicuous hairs; intervals finely, densely, and obsoletely reticulate-striolate; last segment narrowly rounded at the tip, with a very feebly triangular emargination at the apex, the portion in front of the marginal groove broadly rounded at tip. Metasternum more coarsely punctured, and the intervals smoother at the middle than on the abdomen, and with a deep, elongate emargination at the middle of the anterior margin. Prosternum glabrous, finely and densely granulated, the granulation becoming smoother on the prosternal process; anterior margin nearly truncate; prosternal process parallel, sides carinate, the carinae expanding behind the coxae, and the apex broadly rounded.

Female.—Differs from the male in having the last abdominal segment narrowly rounded at the apex, and armed with 11 rather long teeth, which are slightly bent downward and placed close together; the median tooth is wider, longer, and broadly rounded at apex; balance of teeth narrow, very acute at the apex, and placed obliquely on each side of the median tooth.

Length, 2.5 mm.; width, 1.3 mm.

Type locality.—Paraiso, Canal Zone, Panama.

Other localities.—Pedro Miguel, Canal Zone, Panama.

Type, allotype, and *paratype.*—Cat. No. 25118, U.S.N.M.

Described from three specimens, two males and one female. The type and allotype were collected by E. A. Schwarz at the type locality, February 5 and 8, 1911; the male paratype was taken by the same collecter at Pedro Miguel, Panama, April 17, 1911.

This species is closely allied to *variabilis* Waterhouse, but differs from it in color, by being more convex, head much narrower in front, epistoma very narrow, and the antennae nearly contiguous.

LIUS TIMIDUS Kerremans.

Lius timidus KERREMANS, Ann. Soc. Ent. Belg., vol. 44, 1900, pp. 349–350.

This species was described from Guatemala and has not been seen by the writer. It has been placed in the key solely upon the characters given in the original description.

LIUS ARES Saunders.

Lius ares SAUNDERS, Ent. Monthly Mag., vol. 13, 1876, p. 49.

This species was described from material collected by Bates at Para, Ega, and Santarem, along the Amazon River in Brazil.

Waterhouse (Biol. Centr.-Amer., vol. 3, pt. 1, 1889, p. 135) states that he is unable to separate the specimens collected by Mr. Champion in Panama and Honduras from the type. It is represented in the National Museum Collection by three specimens received from F. D. Godman and labeled as follows: "Bugaba, Panama, Champion" and "Volcan de Chiriqui, 25–4000 feet. Champion."

LIUS MEXICANUS, new species.

Male.—Elongate, broadly cuneiform, moderately convex and feebly flattened on top, strongly attenuate posteriorly, shining, and uniformly aeneous above and beneath, with a slight cupreous tinge.

Head feebly convex, broadly and deeply depressed on the front, the depression becoming obsolete on posterior part of occiput, with a narrow, deep, longitudinal groove, extending from the occiput to the epistoma, posterior to which the groove is broadly triangular and flattened, the sides arcuately rounded; front wide, about two times as wide as the transverse diameter of the eye; surface sparsely punctate, the punctures very shallow and obsolete, sparsely clothed with short, recumbent, inconspicuous hairs; intervals finely, densely, and obsoletely reticulate-striolate posteriorly, becoming smooth on the triangular area behind the epistoma; eyes flattened; epistoma wide, the antennae widely separated. Pronotum feebly convex, nearly three times as wide as long at base, distinctly narrower in front than behind, widest at base; sides when viewed from above are parallel at base for a very short distance, then strongly, obliquely attenuate to the anterior angles; posterior angles obtusely rounded and feebly projecting; anterior margin feebly sinuate; base feebly sinuate to beyond middle of elytron, then turning obliquely backward to the scutellum, in front of which it is truncate; surface with an obsolete longitudinal groove at middle, sparsely, coarsely, and distinctly punctate, and sparsely clothed with short, recumbent, inconspicuous hairs; intervals finely and obsoletely reticulate-striolate. Scutellum triangular; anterior margin truncate; surface smooth. Elytra moderately convex, slightly flattened on the top, as wide as pronotum at base; humeral angles obtusely angulated; sides nearly parallel to basal third, then strongly, arcuately attenuate to the tips, which are separately, narrowly rounded, the lateral margins rather strongly serrate; humeri rather prominent; each elytron with a broad, shallow depression at the base, a very narrow, shallow one behind the humeral angle, a broad, obsolete one behind the humerus, a similar obsolete one along lateral margin just behind the middle, and a broad, obsolete one along the suture at the apical third, which extends narrowly along the suture to the apex; surface wrinkled at the sides, coarsely, irregularly, and rather densely punctate, sparsely clothed with short, recumbent, inconspicuous hairs; intervals smooth on the disk, becoming finely granulated at the sides. Abdomen beneath sparsely and irregularly punctate, the punctures very shallow and obsolete, sparsely clothed with rather long, recumbent, cinereous hairs which are slightly longer on the last segment; intervals finely, densely, and obsoletely reticulate-striolate; last segment narrowly rounded at tip, with a small triangular emargination at the apex. Metasternum more coarsely punctured, and the intervals smoother at the middle than on the abdomen, and with a deep, elongate emargination at the middle of the anterior margin. Prosternum finely and densely granulated, and with a few inconspicuous hairs; anterior margin broadly rounded; posternal process narrow, nearly parallel, sides carinate, the carinae parallel, and the apex broadly rounded.

Length, 3.25 mm.; width, 1.6 mm.

Type locality.—Tepic, Mexico.

Type.—Cat. No. 25119, U.S.N.M.

Described from a single male specimen collected by Gustav Eisen and labeled "U.S.N.M. Acc. 31016."

This species is closely allied to *ares* Saunders, but differs from it in being entirely aeneous, pronotum obsoletely, longitudinally grooved at middle, eyes flat, scutellum longer, head more densely punctured, and the last abdominal segment of the male more deeply emarginate.

LIUS DISSIMILIS Waterhouse.

Lius dissimilis WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, pp. 135–136, pl. 7, fig. 18.

Described from material collected by Mr. Champion near Guatemala City, Guatemala, at an elevation of 5,000 feet. The type, which is in the British Museum, has not been examined, and the species has been placed in the key from the characters given in the original description.

LIUS PARVULUS Waterhouse.

Lius parvulus WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, pp. 136–137.

This species was described from material collected by Mr. Champion at Bugaba, Volcan de Chiriqui, and Taboga Island, Panama, without designating any definite type locality. It is represented in the National Museum Collection by a single specimen, which is probably a paratype, received from F. D. Godman, and labeled "Bugaba, 800–1500 ft. Champion." Besides this specimen the National Museum Collection also contains the following: Seven specimens collected at Paraiso, Canal Zone, Panama, between January 17 and April 6, 1911, by E. A. Schwarz, and another specimen collected at the same locality, April 10, 1911, by A. H. Jennings.

LIUS PARVULUS, var. Waterhouse.

Lius parvulus, var. WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 136–137.

This variety with the head and pronotum cupreous or cupreoaeneous, is recorded by Waterhouse as occurring with the typical form at Bugaba, Panama, and also from Zapote, Guatemala, but without giving it any varietal name. It differs only slightly from the descripton given for *Lius amabilis*, described by Kerremans from Mexico, and it is just possible that two forms are identical. It is represented in the National Museum Collection by the following material: Five specimens collected at Paraiso, Canal Zone, Panama, between January 16 and March 18, 1911, by E. A. Schwarz; two others from the same locality collected April 10, 1911, by A. H. Jennings; and another specimen collected at Finca Trece Aguas, Alta Vera Paz, Guatemala, at an altitude of 900 feet, March 30, 1906, by Messrs. Barber and Schwarz.

LIUS VARIABILIS Waterhouse.

Lius variabilis WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 136.

This species was described from material collected by Mr. Champion at Chiacam, San Joaquin, and San Geronimo, Guatemala, without designating any definite type locality. It is represented in the National Museum Collection by a single specimen, which may be one of the paratypes, received from F. D. Godman and labeled "S. Gerónimo, 3000 ft. Champion." This species is longer in proportion to its width than any of the other species examined, and is more regularly convex. The color is quite variable, and the specimen in the National Collection has the head, pronotum, and scutellum aeneous, and the elytra of a purplish-coppery color, with a slight greenish tinge on the disk.

LIUS AMABILIS Kerremans.

Lius amabilis KERREMANS, Ann. Soc. Ent. Belg., vol. 40, 1896, pp. 329–330.

Described from material collected in the refuse of tobacco imported into Paris, France, from Mexico. The origin of the specimens collected under these conditions should be verified, as tobacco from Brazil and other localities was stored in the same building. It is placed in the key solely upon the characters given in the original description. From the description given it is closely allied to the variety of *parvulus* with the cupreous pronotum, recorded by Waterhouse from Panama and Guatemala.

Genus TAPHROCERUS Solier.

Taphrocerus SOLIER, Ann. Soc. Ent. France, ser. 1, vol. 2, 1833, pp. 314–315.

The species of this genus are elongate and agriliform, and their distribution is confined to the Western Hemisphere. The genus contains about 42 previously described species, of which 2 are found in the West Indies, 7 in the United States, 11 in Mexico and Central America, and the remainder in South America.

KEY TO THE SPECIES.

1. Elytra with lateral carina 2
   Elytra without lateral carina 5
2. Black or greenish species 3
   Aeneous species 4
3. Black species; pronotum with lateral carina .... **nigritulus** Waterhouse.
   Bottle-green species; pronotum without lateral carina ...... **albofaciatus** Fisher.
4. Lateral carina sinuate, following the curves of the lateral margin .... **costatus** Waterhouse.
   Lateral carina straight for one-half its length, and parallel to the suture .... **fasciatus** Waterhouse.
5. Elytra with pubescent spots 6
   Elytra without pubescent spots 9
6. Black species .... **guttatus** Waterhouse.
   Aeneous species 7
7. Robust species, subopaque .... {**mexicanus** Waterhouse. **leoni** Dugès.
   Cylindrical species, shining 8
8. Elytra with distinct white pubescent fascia near apex; front of head without transverse pubescent fascia; last abdominal segment with the lateral groove obtusely rounded, following outline of lateral margin, but not reaching it. **psilopteroides** Waterhouse.
   Elytra without distinct white pubescent fascia at apex, but with apical third sparsely clothed with white hair; front of head with transverse, pubescent fascia; last abdominal segment with the lateral groove angulate, transverse, and reaching to the lateral margin .... **sulcifrons** Fisher.
9. Pronotum with short, lateral carina .... **uniformis** Waterhouse.
   Pronotum without lateral carina 10
10. Elytral punctures with distinct hairs 11
    Elytral punctures without distinct hairs 12
11. Pronotum transversely concave in front of scutellum, surface smooth; last abdominal segment rounded at apex, without concave depression between lateral groove and apical margin .... **purpureipennis** Waterhouse.
    Pronotum not transversely concave in front of scutellum, surface finely granulated; last abdominal segment truncate at apex, with an elongate depression between the lateral groove and apical margin .... **kerremansi** Dugès.
12. Pronotum widest near middle, sides arcuate, base not as wide as elytra. **communis** Waterhouse.
    Pronotum widest at base, sides oblique, base wider than the elytra. **attenuatus** Fisher.

TAPHROCERUS NIGRITULUS Waterhouse.

Taphrocerus nigritulus WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 128.

This species was described from San Miguel in the Pearl Islands, Panama, and the type is in the British Museum. It is represented in the National Museum Collection by two specimens collected at Panama City, Panama, April 23, 1911, by A. H. Jennings.

TAPHROCERUS ALBOFASCIATUS, new species.

Female.—Elongate, strongly attenuate posteriorly, moderately convex and strongly flattened on top, with pubescent spots above, head greenish-bronze, pronotum and elytra bottle-green, with a strong violaceous tinge, scutellum brown; beneath piceous, with a strong aeneous tinge.

Head much narrower than pronotum at base, feebly convex and broadly flattened in front of epistoma, with a rather shallow, longitudinal groove extending from the occiput to the middle of the front, where it is connected to a wide, transverse depression; surface very sparsely, irregularly, and coarsely punctate, the punctures becoming much finer and nearly obsolete on the occiput and near the epistoma, clothed with long, recumbent, cinereous pubescence, the hairs becoming denser in the flattened area in front of epistoma and along the eyes; intervals finely and densely granulated. Pronotum moderately convex, nearly two times as wide as long, considerably narrower in front than behind, widest near the middle; sides when viewed from above are strongly, arcuately rounded to the basal fourth, then parallel to the posterior angles, which are rectangular; anterior margin feebly sinuate, and broadly lobed at middle; base transversely truncate to middle of the elytron, then turning obliquely backward to the scutellum, in front of which it is feebly arcuately emarginate; surface with a broad, obsolete depression along anterior margin, and a more narrowly obsolete one along the sides, obsoletely concave in front of scutellum, with a large transverse depression on each side, which is prolonged obliquely toward the anterior angles, these depressions cause the anterior part of the disk to be rather strongly convex, and with a rather broad gibbosity on each side near the posterior angles, with large shallow punctures placed rather closely in the depression, from the center of each arises a rather long, recumbent, yellowish hair; intervals and convex areas finely and densely granulated. Scutellum triangular, obsoletely reticulate, feebly rounded in front. Elytra feebly convex, strongly flattened on top, wider than pronotum at base; humeral angles obtusely angulated; sides strongly arcuately concave from the humeral angles to the middle, where they are broadly rounded and slightly wider than at the base, then rather strongly attenuate to the tips, which are separately, broadly rounded, and obsoletely serrate; humeri well developed; each elytron with a broad, moderately deep basal depression, and with a very distinct lateral carina extending from the humerus to near the apex, but not quite reaching it, the carina strongly sinuate and following the curves of the sides of the elytron; surface with several rows of coarse, shallow punctures, the rows varying somewhat in length, but not extending beyond the middle, the pubescent areas are finely and densely punctate; intervals finely rugose anteriorly, becoming much smoother toward the apex; each elytron ornated with two transverse fasciae, composed of rather densely placed, long, recumbent, cinereous pubescence as follows: A wide, irregular one at the middle, and the other covering the apical sixth; there is also a broad, irregular area of pubescence of the same color behind the scutellum, which is connected to the middle fascia by a narrow, longitudinal fascia at the middle, the surface between the fasciae is also densely clothed with erect, inconspicuous, black hairs. Abdomen beneath moderately convex, sparsely and rather coarsely punctate, the punctures shallow, rounded, and open on the one side, clothed with long, recumbent, inereous hairs, the pubescence very sparse on the median parts, becoming much denser toward the sides; intervals finely and densely reticulate; last segment somewhat flattened, and broadly rounded at apex, with the apical groove broadly truncate at tip. Metasternum more densely punctured than abdomen, and sparsely pubescent. Prosternum finely and densely rugose.

Length, 4 mm.; width, 1.5 mm.

Type locality.—Alhajuelo, Panama.

Type.—Cat. No. 25120, U.S.N.M.

Described from a single female specimen collected by August Busck, April 5, 1911. This beautiful insect belongs to the group of species which have a distinct lateral carina on the elytron, and can be easily distinguished from the other species of this group by the color of the elytra, which is bottle-green, with a strong violaceous tinge.

TAPHROCERUS COSTATUS Waterhouse.

Taphrocerus costatus WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, pp. 127-128.

This species was described from Cordoba, Mexico, and Caban in Vera Paz, Guatemala, and the type, which is in the British Museum, has not been examined. The species has been placed in the key solely upon the characters given in the original description.

TAPHROCERUS FASCIATUS Waterhouse.

Taphrocerus fasciatus WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 128.

The type locality for this species is Caldera in Chiriqui, Panama, at an elevation of 1,200 feet. The type is in the British Museum and has not been examined. It is placed in the key from the characters given in the original description.

TAPHROCERUS GUTTATUS Waterhouse.

Taphrocerus guttatus WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 129.

This species was described from San Juan in Vera Paz, Guatemala, and the type, which is in the British Museum, has not been examined. This species has also been reported from Panama, and is represented in the National Museum Collection by a single example collected at Livingston, Guatemala, May 11, 1906, by Barber and Schwarz.

TAPHROCERUS MEXICANUS Waterhouse.

Taphrocerus mexicanus WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, pp. 128–129.

This species was described from material collected in a number of localities in Mexico and Guatemala, without giving any definite type locality. The type is in the British Museum and has not been examined. There is only one specimen in the National Museum Collection which would apply to this species, but for the present is retained under the following species, which is probably a synonym.

TAPHROCERUS LEONI Dugès.

Taphrocerus leoni DUGÈS, La Naturaleza, ser. 2, vol. 2, 1891, p. 35, pl. 2, fig. 61, 61*a*.

This species was described from Tupataro, State of Guanajuato, Mexico, and the location of the type is unknown to the writer. There is a specimen in the National Museum Collection, which was received for determination from Eugenio Dugès a number of years previous to the publication of his description of *Taphrocerus leoni*, and labeled in his own handwriting, "No. 562, *Brachys albosignatus* E. Dug.," without any locality given. This is probably a manuscript name of Dugès, and no published description of it can be found. This specimen probably was taken from a set, from which he described this species a few years later. Waterhouse described his *Taphrocerus mexicanus* from a series of specimens, including material from Sallé, which is from the same locality as *leoni* described by Dugès. In carefully comparing the descriptions, I can not find sufficient characters for separating the two species, and probably *Taphrocerus leoni* Dugès is a synonym of *Taphrocerus mexicanus* Waterhouse.

A specimen received from Prof. H. F. Wickham, which was collected by himself at Tepehuanes, Durango, Mexico, differs slightly from the specimen from Tupataro by being slightly more slender and brassy, the pubescent spots not quite as distinct, but the brassy punctured areas are present, which indicates that the surface has been denuded of some of the pubescence.

TAPHROCERUS PSILOPTEROIDES Waterhouse.

Taphrocerus psilopteroides WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 129.

This species was described from Chiacam, Guatemala, and the type is in the British Museum. It has been reported also from Mexico and Panama by Waterhouse, and is represented in the National Museum Collection by three examples; one collected at Paraiso, Canal Zone, Panama, January 26, 1911, by E. A. Schwarz; one collected at La Ceiba, Honduras, August 15, 1916, by F. J. Dyer; and another specimen swept from grass and cowpeas at Juan Mina plantation, Canal Zone, Panama, July 13, 1918, by H. F. Dietz and J. Zetek.

TAPHROCERUS SULCIFRONS, new species.

Male.—Elongate, attenuate posteriorly, subcylindrical, uniformly brownish, with a strong aeneous tinge, and with pubescent spots above; beneath of the same color as above.

Head nearly as wide as pronotum at base, feebly convex and broadly flattened behind the epistoma, causing two feeble, smooth gibbosities on the front, with a longitudinal groove extending from the occiput to near the epistoma, the groove obsolete on the occiput, but becoming deeper on the vertex and front; surface sparsely, irregularly, and coarsely punctate, the punctures very shallow and obsolete on the occiput, and much finer and denser on the flattened area behind the epistoma, sparsely clothed with short, inconspicuous hairs, except along the epistoma, where the pubescence is longer and much denser; intervals finely and densely granulated. Pronotum moderately convex, one and two-thirds times as wide as long, slightly narrower in front than behind, widest at the base; sides when viewed from above feebly, obliquely dilated to the posterior angles, which are rather obtuse; anterior margin truncate; base transversely truncate to middle of elytron, then turning obliquely backward to the scutellum, in front of which it is feebly, arcuately emarginate; surface with a broad obsolete depression along the anterior margin, and a more narrow, obsolete one along the sides, broadly concave in front of scutellum, the concavity extending on each side into a deep depression, which is prolonged obliquely toward the anterior angles, these depressions cause the surface to be broadly gibbose on the median anterior part, and a small gibbosity on each side near the posterior angles, sparsely, irregularly punctate, the punctures very shallow and somewhat denser in the depressions, sparsely clothed with short, recumbent, cinereous hairs; intervals finely and densely granulated. Scutellum triangular, obsoletely reticulate, feebly rounded in front. Elytra rather strongly convex, slightly narrower than pronotum at base; humeral angles rather obtusely angulated; sides rather strongly sinuate behind the humeri, as wide at the middle as at the humeral angles, strongly attenuate from the middle to the apex, which is conjointly broadly rounded, and obsoletely serrate; humeri well developed; each elytron with a deep, rather broad basal depression, and without lateral carina; surface with rows of punctures which are large at the base, but gradually becoming smaller toward the apex, where they are not very distinct, with an obsolete broken, transverse fascia at middle, and the entire apical third very sparsely clothed with rather long, recumbent, cinereous hairs; there are also a few scattered hairs of the same color behind the scutellum; intervals shining and coarsely rugose anteriorly, becoming finely and densely granulated at apex. Abdomen beneath moderately convex, sparsely and obsoletely punctate, the punctures shallow, oblong, and open on the one side, each puncture bearing a short, recumbent hair; intervals finely and densely reticulate; last segment broadly rounded at apex, with the apical groove broadly angulated at middle. Metasternum more coarsely and distinctly punctured than the abdomen. Prosternum finely and densely rugose.

Length, 3 mm.; width, 1 mm.

Type locality.—Juan Mina, Canal Zone, Panama.

Type.—Cat. No. 25121, U.S.N.M.

Described from a single male specimen collected by J. Zetek February 18, 1921. This species resembles *T. attenuatus* Fisher in form and color, but is not as strongly attenuate posteriorly, and the elytra is ornated with transverse pubescent fasciae.

TAPHROCERUS UNIFORMIS Waterhouse.

Taphrocerus uniformis Waterhouse, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 130.

This species was described from specimens collected near Mexico City, Mexico, and the type, which is in the British Museum, has not been examined. The species has been placed in the key solely upon the character given in the original description.

TAPHROCERUS PURPUREIPENNIS Waterhouse.

Taphrocerus purpureipennis Waterhouse, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, pp. 129–130.

This species was described from material collected on Taboga Island, Panama, by Mr. Champion. It is represented in the National Museum Collection by the following material: One specimen collected at Paraiso, Canal Zone, Panama, April 19, 1911, by E. A. Schwarz; one collected at Juan Mina, Canal Zone, Panama, February 18, 1921, by J. Zetek; and two other specimens collected at Finca Trece Aguas, Alta Vera Paz, Guatemala, at an altitude of 900 feet, March 26 and April 15, 1906, by Barber and Schwarz. The specimens from Guatemala are not quite as broad as those from Panama, and have the head a little more deeply grooved.

TAPHROCERUS KERREMANSI Dugès.

Taphrocerus kerremansi DUGÈS, La Naturaleza, ser. 2, vol. 2, 1891, pp. 35–36, pl. 2, figs. 62, 62*a*.

This species was described from material collected at Tupataro, Mexico. There is a specimen in the National Museum Collection, collected at Tampico, Mexico, December 6, by F. C. Bishopp, which agrees very well with the description given by Dugès for this species.

TAPHROCERUS COMMUNIS Waterhouse.

Taphrocerus communis WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 130.

The type locality of this species is Atoyac in Vera Cruz, Mexico, and the type, which is in the British Museum, has not been examined. It has been reported also by Waterhouse from Guatemala and Panama, and varies somewhat in color and form. It is represented in the National Museum Collection by the following material: Two specimens from La Ceiba, Honduras, collected November 29, 1916, by F. J. Dyer; two from Paraiso, Canal Zone, Panama, April 19 and January 26, 1911, and one from Porto Bello, Panama, February 15, 1911, all collected by E. A. Schwarz; one from Panama City, Panama, April 15, 1911, collected by A. H. Jennings; two from Corozal, Canal Zone, March, 1912, one from Paraiso, Canal Zone, January 19, 1911, and another specimen from Taboga Island, February 26, 1912, all from Panama and collected by August Busck; one from Minatitlan, Mexico, February 1, 1892, collected by H. Osborn; and another specimen collected by J. Zetek at Juan Mina, Canal Zone, Panama, on February 18, 1921.

TAPHROCERUS ATTENUATUS, new species.

Male.—Elongate, strongly attenuate posteriorly, subcylindrical uniformly piceous above, with a strong aeneous tinge, and without pubescent spots; beneath slightly darker than above.

Head slightly narrower than pronotum at base, feebly convex, with a longitudinal groove extending from the occiput to the epistoma, the groove quite deep on the front and becoming obsolete on the occiput; surface with a few irregular, coarse, and very shallow punctures, and clothed with a few inconspicuous hairs; intervals very finely reticulate, becoming nearly smooth on the front. Pronotum moderately convex, one and one-half times as wide as long, slightly narrower in front than behind, widest at base; sides when viewed from above feebly, obliquely dilated to the basal sixth, then parallel to the posterior angles, which are rectangular and feebly projecting beyond the humeral angles of the elytra; anterior margin truncate; base transversely truncate to middle of elytron, then turned obliquely backward to the scutellum, in front of which it is feebly, arcuately emarginate; surface with a broad, obsolete depression along anterior margin, and with the sides broadly depressed, the depression becoming obliquely broader posteriorly, and broadly concave along the base, causing the median anterior part of disk to be strongly convex, sparsely, irregularly punctate, the punctures very shallow, obsolete, and from the center of which arises a very short, inconspicuous, cinereous hair; intervals finely and densely reticulate. Scutellum triangular, obsoletely reticulate, feebly rounded in front. Elytra rather strongly convex, slightly narrower than pronotum at base; humeral angles rather obtusely angulated; sides rather strongly sinuate behind the humeri, as wide at the middle as at the humeral angles, strongly, obliquely attentuate from the middle to the apex, which is conjointly, broadly rounded, and obsoletely serrate; humeri well developed; each elytron with a deep, rather broad basal depression, and without lateral carina; surface with rows of large, shallow punctures, which are less impressed toward the apex, the rows somewhat confused near the base, and each puncture bearing a very inconspicuous, cinereous hair; intervals coarsely rugose anteriorly, becoming finely and densely granulate at the apex. Abdomen beneath strongly convex, sparsely and obsoletely punctate, the punctures shallow, oblong, and open on the one side, very sparsely clothed with obsolete, cinereons hairs; intervals finely and densely reticulate; last segment broadly rounded at apex, with the apical groove following the outline of the margin. Metasternum with the surface similar to that of the abdomen. Prosternum finely and densely rugose.

Length, 2.75 mm.; width, 1. mm.

Type locality.—Panama City, Panama.

Type and *paratype.*—Cat. No. 25122, U.S.N.M.

Described from two male specimens collected by A. H. Jennings April 23, 1911. This species resembles *T. communis* Waterhouse very closely, but can be distinguished from that species by the pronotum being widest at the base and the elytra not quite as wide as the pronotum.

Genus CALLIMICRA Deyrolle.

Callimicra H. DEYROLLE, Ann. Soc. Ent. Belg., vol. 8, 1864, p. 219.

This genus contains 29 described species, and their distribution is restricted to Mexico, Central and South America. Of this number, only 6 species have been described from Mexico and Central America, and the remainder of the species from South America.

KEY TO THE SPECIES.

1. Pronotum with a lateral carina 2
   Pronotum without a lateral carina 5
2. Above unicolored .... **obtusa Waterhouse.**
   Above bicolored 3

3. Elytra violaceous .... **violaceipennis** Waterhouse.
   Elytra cyaneous.. 4
4. Pronotum with sides arcuately attenuate from base to apical angles, and distinctly narrower in front than behind.................... **lucida** Waterhouse.
   Pronotum with sides nearly parallel, and scarcely narrower in front than behind. **angustula** Waterhouse.
5. Each elytron with two or three rows of fine punctures.... **dimidiata** Waterhouse.
   Punctures on elytron not arranged in rows........... **breviuscula** Waterhouse.

CALLIMICRA OBTUSA Waterhouse.

Callimicra obtusa WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 164.

This species was described from Bugaba, Panama, and the type is in the British Museum. It is represented in the United States National Museum Collection by two specimens collected at Trinidad River, Panama, March 21, 1911, by August Busck, and another specimen collected at La Chorrera, Panama, May 18, 1912, by the same collector. The specimens from Trinidad River have the underside piceous, with exception of the metasternum, which is green. One of the specimens has the front of the head uniformly dark blue, while in the other one it is bronzy. The specimen from La Chorrera differs slightly in being longer, underside entirely piceous, and the last abdominal segment more acutely rounded.

CALLIMICRA VIOLACEIPENNIS Waterhouse.

Callimicra violaceipennis WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 165.

This species was described from Playa Vicente, Mexico, and the type, which is in the British Museum, has not been examined. The species has been placed in the key solely upon the characters given in the original description.

CALLIMICRA LUCIDA Waterhouse.

Callimicra lucida WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 165.

This species was described from Bugaba, Panama, and the type is in the British Museum. It is represented in the National Museum Collection by four examples; two collected at La Chorrera, Panama, May 18, 1912, by August Busck; one specimen collected at Paraiso, Canal Zone, Panama, April 29, 1911, by E. A. Schwarz; and the other one at Esparza, Costa Rica, September 18, 1905, by Frederick Knab.

CALLIMICRA ANGUSTULA Waterhouse.

Callimicra angustula WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 166, pl. 9, fig. 10.

This is one of the narrow species of the genus and was described from Tuxtla, Mexico; San Juan in Vera Paz, Guatemala; and Volcan de Chiriqui, Panama. The type is in the British Museum and has not been examined. It is placed in the key on the basis of the original description.

CALLIMICRA DIMIDIATA Waterhouse.

Callimicra dimidiata WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 164, pl. 9, fig. 9.

This species is much broader than *angustula* and was described from Bugaba, Panama, and the type, which is in the British Museum, has not been examined. It has been placed in the key from the characters given in the original description.

CALLIMICRA BREVIUSCULA Waterhouse.

Callimicra breviuscula WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, pp. 165–166.

The type locality of this species is San Miguel del Rio, Orizaba, Mexico. The type is in the British Museum and has not been examined. It is represented in the National Museum Collection by a single example from Mexico, without any definite locality, which was received from L. Conradt, Colima, State of Colima, Mexico. This specimen differs somewhat in color from the original description by having the disk of pronotum strongly cupreous and the elytra with a slight greenish and violaceous tinge.

Genus LEIOPLEURA Deyrolle.

Leiopleura H. DEYROLLE, Ann. Soc. Ent. Belg., vol. 8, 1864, p. 219.

The genus contains about 85 species, 9 of which are described in the present paper. The species of this genus are oblong or ovate, strongly attenuate posteriorly, and their distribution is confined to the warmer sections of the Western Hemisphere. Of this number of species 1 has been described from Cuba, 38 from Mexico and Central America, and the remainder from South America.

Leiopleura viridicollis, described by Gory from Cayenne, Guiana,[8] and recorded by Waterhouse from Bugaba, Panama, has been omitted from the key, as it has been impossible to correlate the characters given in the original description with those used in the key.

KEY TO THE SPECIES.

1.	Pronotum and elytra unicolored	2
	Pronotum and elytra bicolored	9
2.	Surface above piceous	3
	Surface above aeneous, rufo-cupreo, or purplish	7
3.	Head piceous	4
	Head aeneous	trivialis Waterhouse.
4.	Sides of pronotum narrowly flattened	5
	Sides of pronotum broadly flattened	6

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[8] Mon. Bupr. Suppl., vol. 4, 1841, p. 343, pl. 58, fig. 330.

5. Narrow species, not two times as wide as long; pronotum with a deep depression near posterior angles, where the surface is obsoletely rugose, the sides distinctly margined .... **minuta** Kerremans.
Broader species, more than two times as wide as long; pronotum without a deep depression near posterior angles, where the surface is strongly rugose, the sides obsoletely margined .... **nigra** Waterhouse.
6. Pronotum with the disk regularly convex .... **crassa**, var. Waterhouse.
Pronotum with two lunate depressions on the disk .... **picea** Fisher.
7. Head black; surface above purplish .... **parvula** Waterhouse.
Head aeneous or bluish-green 8
8. Surface above brunneo-aeneous .... **convexa** Waterhouse.
Surface above rufo-cupreo .... **jubilans** Waterhouse.
9. Pronotum unicolored 10
Pronotum bicolored 20
10. Elytra bicolored 11
Elytra unicolored 13
11. Pronotum piceous, each elytron dark purple, with a golden-coppery spot at middle, and with apex bright blue .... **ornata** Fisher.
Pronotum green or bronzy 12
12. Elytra dark bronzy, with a transverse light bronzy fascia .... **lata** Kerremans.
Elytra cyaneous, with a strong violaceous tinge; each elytron with two golden-green spots along lateral margin .... **schwarzi** Fisher.
13. Head black 14
Head green, bronzy, or coppery 15
14. Sides of pronotum broadly flattened; elytra dark green .. **crassa**, var. Waterhouse
Sides of pronotum feebly flattened; elytra dark purple. **contigua**, var. Waterhouse.
15. Head coppery 16
Head green or bronzy 18
16. Elytra bluish-green .... **polita** Waterhouse.
Elytra reddish-purple or coppery-red 17
17. Sides of pronotum broadly flattened; head coarsely punctured and intervals densely granulate-striolate; elytra reddish-purple with a strong greenish tinge on disk .... **mutabilis** Fisher.
Sides of pronotum feebly flattened; head obsoletely punctured and striolate elytra coppery-red .... **inconspicua** Waterhouse.
18. Pronotum with the base deeply and transversely depressed .. **crassa** Waterhouse.
Pronotum not transversely depressed along base at middle; surface coarsely punctate 19
19. Intervals on disk of pronotum smooth; color bright green .... **bicolor** Fisher.
Intervals on disk of pronotum densely reticulate-striolate; color dull dark green. **subopaca** Fisher.
20. Elytra bicolored 21
Elytra unicolored 29
21. Elytra cupreous 22
Elytra purplish or violaceous 24
22. Pronotum with the disk broadly infuscated, and sides narrowly margined with green; sutural regions of elytra infuscated .... **intermedia** Waterhouse.
Pronotum with the disk not broadly infuscated; elytra bright coppery-red .. 23
23. Pronotum golden-green, with a narrow purple band on disk becoming slightly wider than scutellum at base; margin of elytra violaceous. **beltii** Waterhouse.
Pronotum dark green, with an obscure dark triangular area on anterior part of disk, but not extending to base; elytra with humeral angles violaceous, and the lateral margin aureous .... **buscki** Fisher.

24. Elytra purplish, with two bright green fasciae on each elytra. **divisa** Waterhouse.

Elytra dark violaceous, ornated with green or coppery fasciae 25

25. Pronotum with short lateral carinae 26

Pronotum without lateral carinae 28

26. Apex of elytra green, and with a median coppery-red fascia interrupted at the suture; pronotum with anterior part of disk brownish-black. **basalis** Waterhouse.

Apex of elytra not green 27

27. Pronotum with entire disk brownish-black; each elytron with a bright green band, commencing close to the scutellum and extending obliquely to the middle of elytron, where it meets a slightly oblique tranverse band, and with a transverse spot near apex, which does not reach the suture. **puncticeps** Waterhouse.

Pronotum with a narrow brownish spot on disk; each elytron with a green spot at scutellum and a transverse lateral one at middle, connected to each other by a narrow line, and with a subapical fascia, which reaches to the suture. **venusta** Waterhouse.

28. Transverse green fascia on elytra interrupted at the suture; head bluish-green. **interrupta** Waterhouse.

Transverse green fascia on elytra not interrupted at the suture; head golden-green .... **pulchra** Waterhouse.

29. Pronotum with the disk black, brownish-black, bronzy, or blue 30

Pronotum with a median green band; sides dark blue, with a purplish tinge. **longula** Waterhouse.

30. Pronotum with disk black, brownish-black, or bronzy 31

Pronotum blue, with the sides green and the front margin cupreous. **viridifrons** Waterhouse.

31. Disk of pronotum bronzy 32

Disk of pronotum black or brownish-black 35

32. Base of pronotum transversely depressed 33

Base of pronotum not transversely depressed 34

33. Pronotum with the anterior angles tinted with green .... **aeneifrons** Waterhouse.

Pronotum with the sides bluish or greenish .... **attenuata** Fisher.

34. Pronotum with the sides broadly flattened, and the anterior margin greenish. **inaequalis** Kerremans.

Pronotum with the sides feebly flattened, and the anterior angles brassy. **difficilis** Waterhouse.

35. Elytra bright copper-red, with the humeral angles violaceous, and the lateral margins aureous; pronotum dark green, with an obscure dark triangular area on disk .... **buscki** Fisher.

Elytra purplish, black, or dark blue 36

36. Elytra black 37

Elytra purplish or dark blue 39

37. Head entirely black .... **nitidicollis** Kerremans.

Head green or bronzy 38

38. Pronotum with the sides coppery-red .... **levis** Kerremans.

Pronotum with the sides green .... **lateralis** Waterhouse.

39. Elytra dark blue .... **placida** Waterhouse.

Elytra of a dark purplish color 40

40. Disk of pronotum with stelliform punctures .... **contigua** Waterhouse.

Disk of pronotum with round, shallow, and sparsely placed punctures. **purpureipennis** Fisher.

LEIOPLEURA TRIVIALIS Waterhouse.

Leiopleura trivialis WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 159, pl. 9, fig. 5.

This species was described from material collected by Mr. Champion on Taboga Island, Panama. The type is in the British Museum and and has not been examined. The species is placed in the key from the characters given in the original description.

LEIOPLEURA MINUTA K.

Leioplcura minuta KERREMANS, Ann. Soc. Ent. France, vol. 63, 1894, p. 422.

Described from material collected in the refuse of tobacco imported into Paris, France, from Mexico. It is represented in the National Museum Collection by one specimen collected at Tampico, Mexico, December 7, 1909, by E. A. Schwarz.

LEIOPLEURA NIGRA Waterhouse.

Leiopleura nigra WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 159.

Described from material collected by Mr. Champion at Bugaba, Panama, and the type, which is in the British Museum, has not been examined. The species has been placed in the key from characters furnished by a single example collected at Cordoba, Mexico, June 13, by Frederick Knab, which agrees very well with the original description.

LEIOPLEURA PICEA, new species.

Oblong, strongly convex, broadly rounded in front, broadly attenuate posteriorly, and slightly narrower behind than in front, moderately shining, and uniformly piceous above and beneath.

Head feebly convex and narrowly, obsoletely depressed on the front, the depression becoming obscure near the epistoma and on the vertex, with a narrow, longitudinal groove extending from the epistoma to a large, distinct, oblong fovea on the front; surface sparsely and irregularly punctate, the punctures very shallow and becoming obsolete on the front; intervals finely and obsoletely reticulate-striolate; antennae rather short and entirely piceous. Pronotum moderately convex, nearly three times as wide as long, distinctly narrower in front than behind, widest at the base; sides strongly, arcuately attenuate from base to anterior angles; posterior angles nearly rectangular; anterior margin broadly arcuately emarginate; base transversely truncate to near middle of the elytron, then feebly sinuate and turning obliquely backward to the scutellum; in front of which it is truncate; surface rather broadly flattened along the sides, with a broader, shallow depression near the posterior angles, and with two deep, narrow, lunate depressions on the disk, placed one on each side of the middle and about equally distant from base and anterior margin, sparsely and irregularly punctate, the punctures very shallow and obsolete; intervals finely and densely reticulate-striolate, the reticulation becoming more distinct along the sides. Scutellum nearly smooth, and broadly triangular. Elytra rather strongly convex, as wide as pronotum at base, widest at middle; humeral angles obtusely angulated; sides feebly expanding to middle, then strongly, arcuately attenuate to the tips, which are conjointly, broadly rounded, the lateral margins entire; each elytron with a broad, shallow depression at the base, and a narrow one between the humerus and lateral margin, extending along the margin from the humeral angle to middle and becoming much broader behind the humerus; surface somewhat uneven at base, coarsely and irregularly punctate, the punctures obsolete and somewhat confused at base, but becoming finer and smooth toward apex; intervals finely and obsoletely reticulate-striolate. Abdomen beneath finely and densely reticulate-striolate; last segment narrowly rounded at apex. Metasternum with a few large, widely separated punctures, and the intervals finely and obsoletely reticulate-striolate. Prosternum finely and densely reticulate-striolate, with a few fine, obsolete punctures on the prosternal process; anterior margin truncate.

Length, 2.25 mm.; width, 1.3 mm.

Type locality.—Trinidad River, Panama.

Type.—Cat. No. 25123, U.S.N.M.

Described from a single specimen collected by August Busck May 4, 1911.

This species is closely allied to *unicolor* Kerremans, but it is shorter, more robust and convex, and more broadly attenuate posteriorly.

LEIOPLEURA PARVULA Waterhouse.

Leiopleura parvula WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 161, pl. 9, fig. 7.

This species was described from David, Panama, and the type is in the British Museum. It has not been examined by the writer, and the species is placed in the key solely upon the characters given in the original description.

LEIOPLEURA CONVEXA Waterhouse.

Leiopleura convexa WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, pp. 160–161, pl. 9, fig. 6.

Described from material collected by Mr. Champion at Volcan de Chiriqui, Panama, at an altitude of 2,500 feet. This is a very convex species and has not been seen by the writer, but is placed in the key on the basis of the original description.

LEIOPLEURA JUBILANS Waterhouse.

Leiopleura jubilans WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 163.

This species was described from Belize, British Honduras, and bears a great resemblance to *Lius dissimilis*. The type has not been examined, and the species has been placed in the key from the characters given in the original description.

LEIOPLEURA ORNATA, new species.

Oblong, moderately convex, broadly rounded in front, broadly attenuate posteriorly, and slightly narrower behind than in front, moderately shining; head, pronotum, and scutellum piceous, the head greenish on the front; elytra dark purple, with the apex bright blue, and each elytron ornated with a large, golden-coppery spot at the middle, and the side behind the humeral angle narrowly margined with dark blue; beneath piceous.

Head feebly convex, broadly and rather deeply depressed on the front, with a narrow, rather obsolete, longitudinal groove extending from the epistoma to the vertex; surface coarsely and rather sparsely punctate; intervals finely and densely reticulate-striolate; antennae rather short, piceous, with a slight aeneous tinge. Pronotum evenly convex, two and one-half times as wide as long, considerably narrower in front than behind, widest at the base; sides strongly arcuately attenuate from base to anterior angles; posterior angles feebly projecting and rather acute; anterior margin broadly, arcuately emarginate; base transversely truncate to near middle of elytron, then feebly sinuate and turning obliquely backward to the scutellum, in front of which it is obsoletely, arcuately emarginate; surface narrowly flattened along sides, with the margin slightly elevated, and with an obsolete, lateral carina extending from the base to near the middle and nearly parallel to the lateral margin, there is also a broad, shallow depression near the posterior angles, coarsely and sparsely punctate; intervals nearly smooth on the disk, but becoming finely and densely reticulate-striolate toward the sides and in the basal depressions. Scutellum smooth and broadly triangular. Elytra rather strongly convex, as wide as pronotum at base; humeral angles obtusely angulated; sides parallel to middle, then strongly, arcuately attenuate to the tips, which are rather narrowly, conjointly rounded, the lateral margins feebly serrate; humeri well developed; each elytron with a broad, rather deep depression at the base, and a narrower one between the humerus and lateral margin, extending along the margin from the humeral angle to middle, and becoming broader behind the humerus; surface rather coarsely wrinkled at humeral regions, and coarsely, irregularly, and rather densely punctate, the punctures very shallow, but becoming more obsolete toward the apex; intervals finely and obsoletely reticulate-striolate. Abdomen beneath finely and densely reticulate-striolate, with a few short, obscure hairs; last segment broadly rounded at apex. Prosternum obsoletely reticulate-striolate; anterior margin feebly sinuate. Metasternum with a few coarse punctures.

Length, 2.5 mm.; width, 1.4 mm.

Type locality.—Paraiso, Canal Zone, Panama.

Type.—Cat. No. 25124, U.S.N.M.

Described from a single specimen collected by E. A. Schwarz March 18, 1911.

This species is slightly more robust than *picea* Fisher, and each elytron is ornated with a large, golden-coppery spot.

LEIOPLEURA LATA Kerren

Leiopleura lata KERREMANS, Ann. Soc. Ent. France, vol. 63, 1894, p. 422.

Described from material collected in the refuse of tobacco imported into Paris, France, from Mexico. The origin of the specimens collected under these conditions should be verified, as tobacco from Brazil and other localities was stored in the same building. The species is unknown to the writer and is placed in the key from the characters given in the original description.

LEIOPLEURA CRASSA Waterhouse.

Leiopleura crassa WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, pp. 155–156, pl. 9, fig. 3.

This species was described from material collected at Bugaba, Taboga Island, Volcan de Chiriqui, Panama; and Cacoj in Vera Paz, Las Mercedes, and Cerro Zunil, Guatemala. The type locality for the typical form is Bugaba, Panama. The species is very variable in color, and varies from entirely black examples to those with the head and pronotum bluish-green and the elytra dark blue, which is considered the typical form. There are two entirely black specimens in the National Museum Collection; one collected at Porto Bello, Panama, March 9, 1911, by E. A. Schwarz, and the other one at Paraiso, Canal Zone, Panama, April 6, 1911, collected by the same collector, which agree with the description given for the black variety by Waterhouse.

LEIOPLEURA SCHWARZI, new species.

Broadly ovate, feebly convex, slightly longer than wide, broadly rounded in front, slightly narrower behind than in front, and strongly shining; head and pronotum light bluish-green; scutellum brownish; elytra cynaneous, with a strong violaceous tinge, each elytron with two large, golden-green spots along the lateral margin; beneath piceous.

Head feebly convex, broadly and deeply depressed on the front, with a distinct narrow longitudinal groove extending from the epistoma to the vertex, the groove deeply impressed on the front, but becoming obsolete on the vertex; surface coarsely and rather densely punctate; intervals finely and densely granulated; antennae moderately long, piceous, with the first few joints slightly greenish. Pronotum evenly convex, three times as wide as long, considerably narrower in front than behind, widest at the base; sides strongly, arcuately attenuate from the base to anterior angles; posterior angles nearly rectangular; anterior margin deeply, arcuately emarginate; base transversely truncate to near the middle of the elytron, then feebly sinuate and turning obliquely backward to the scutellum, in front of which it is truncate; surface with a broad, shallow depression on each side along the base in front of the elytral depressions, coarsely and rather densely punctate; intervals nearly smooth on the disk, becoming coarsely and densely granulate-striolate toward the sides, and nearly obscuring the punctation. Scutellum smooth and broadly triangular. Elytra moderately convex, as wide as pronotum at base, widest at basal third; humeral angles obtusely rounded; sides broadly, arcuate to middle, then strongly, arcuately attenuate to the tips, which are conjointly, narrowly rounded, the lateral margin obsoletely serrate; humeri well developed; each elytron with a broad, deep depression at base, and a deep, narrow one between the humerus and lateral margin, extending along the margin from the humeral angle to the middle, and becoming broader behind the humerus, ornated with two golden-green fasciae, the first a broad, transverse one at middle, extending from the lateral margin to the sutural fourth, and the second, a somewhat triangular one near the apex, extending from the lateral margin to near the suture, both of these fasciae are slightly oblique, the posterior one more strongly so than the anterior one; surface finely, irregularly, and rather densely punctate, the punctures becoming coarser on the green fasciae; intervals finely and obsoletely reticulate-striolate. Abdomen beneath finely and obscurely punctate, with the intervals finely and densely reticulate-striolate; last segment broadly rounded at apex. Metasternum and prosternum more coarsely punctured than abdomen, the latter with the anterior margin feebly, arcuately emarginate.

Length, 2.85 mm.; width, 2 mm.

Type locality.—Porto Bello, Panama.

Type and *paratype.*—Cat. No. 25125, U.S.N.M.

Described from two specimens collected by August Busck March 3 and 4, 1911.

This species is allied to *pulchra* Waterhouse, but the head and pronotum are not golden-green, and the green fasciae on the elytra do not extend to the suture. It is also closely allied to *claveri* described by Kerremans from Colombia, but differs from that species by having the pronotum entirely green, the scutellum brown, and the anterior green fascia on the elytra not extending around the humeri.

LEIOPLEURA CONTIGUA Waterhouse.

Leiopleura contigua WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889 p. 154, pl. 9, fig. 2.

Described from material collected by Mr. Champion at Volcan de Chiriqui, Panama, at an altitude of 3,500 feet. This species is somewhat variable in color, and Waterhouse describes the typical form as having the elytra dark purple, head and pronotum green, with the median part of the pronotum brownish-black. A second specimen collected at the same locality differs from the type by having the head and entire pronotum black. The species is not represented in the National Collection and is placed in the key solely upon the characters given in the original description.

LEIOPLEURA POLITA Waterhouse.

Leiopleura polita WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 162, pl. 9, fig. 8.

The type locality of this species is Bugaba, Panama, and the type, which is in the British Museum, has not been examined. The species is convex, elongate, and strongly attenuate posteriorly, and in form resembles *parvula*, but differs from it in color. It is placed in the key upon the characters given in the original description.

LEIOPLEURA MUTABILIS, new species.

Oblong, feebly convex, broadly rounded in front, broadly attenuate posteriorly, and slightly narrower behind than in front, moderately shining; head and pronotum dark cupreous, with a slight greenish reflection; scutellum brownish, with an obsolete cupreous tinge; elytra obscurely reddish-purple, with a strong greenish tinge on the disk, and the sides near the humeral angles narrowly margined with violet; beneath piceous.

Head feebly convex and broadly depressed on the front, the depression rather deep at the middle, but becoming obsolete near the epistoma and on the vertex, with a distinct, narrow, longitudinal groove extending from the epistoma to the front, where it is abruptly ended; surface coarsely and rather sparsely punctate; intervals densely and finely granulate-striolate; antennae rather short and entirely piceous. Pronotum moderately convex, two and one-half times as wide as long, narrower in front than behind, widest near the base; sides nearly parallel to basal fourth, then strongly, arcuately attenuate to the anterior angles; posterior angles feebly projecting and rather acute; anterior margin broadly, arcuately emarginate; base feebly, transversely sinuate to near middle of elytron, then turning obliquely backward to the scutellum, in front of which it is obsoletely, arcuately emarginate; surface rather broadly flattened along the sides, the lateral margin slightly elevated, and with an obsolete lateral carina, which is more distinct at middle than base, there is also a broad deep depression in front of the posterior angle, sparsely punctate, the punctures very shallow and stelliform; intervals nearly smooth on the disk, becoming densely granulate-striolate at the sides and in the depressions. Scutellum nearly smooth and broadly triangular. Elytra feebly convex, as wide as pronotum at base, widest just behind the middle; humeral angles broadly rounded, sides feebly expanding to just behind the middle, then strongly, arcuately attenuate to the tips, which are conjointly narrowly rounded, the lateral margins distinctly serrate; humeri prominent; each elytron with a broad deep depression at the base, and narrow, deeper one between the humerus and the lateral margin, extending along the margin from the humeral angle to near the apex, the depression is slightly broader behind the humerus; surface slightly wrinkled at the sides, coarsely, irregularly, and rather densely punctate, the punctures becoming obsolete behind the middle; interval nearly smooth. Abdomen beneath finely and densely reticulate-striolate, with a few obsolete punctures, and very sparsely clothed with short, inconspicuous, cinereous hairs. Prosternum punctured similar to that of the abdomen; anterior margin feebly sinuate. Metasternum more coarsely punctured than abdomen.

Length, 2.4 mm.; width, 1.25 mm.

Type locality.—Paraiso, Canal Zone, Panama.

Type and *paratype.*—Cat. No. 25126, U.S.N.M.

Described from two specimens collected by E. A. Schwarz April 18, 1911.

LEIOPLEURA INCONSPICUA Waterhouse.

Leiopleura inconspicua WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 162.

This species was described from material collected by Mr. Blancaneaux at Belize, British Honduras. It is unknown to the writer and is placed in the key on the basis of the original description.

LEIOPLEURA BICOLOR, new species.

Oblong, moderately convex, broadly rounded in front, broadly attenuate posteriorly, and nearly as wide behind as in front, strongly shining; head and pronotum bright green; scutellum piceous; elytra cyaneous; beneath piceous.

Head feebly convex, and broadly depressed on the front, the depression rather deep on the front but becoming obsolete on the vertex, with a narrow, obsolete, longitudinal groove extending from the epistoma to a small, obscure fovea on the front; surface coarsely, irregularly, and sparsely punctate; intervals smooth; antennae rather short and entirely piceous. Pronotum moderately convex, three times as wide as long, distinctly narrower in front than behind, widest near the base; sides nearly parallel to basal fourth, then strongly, arcuately attenuate to anterior angles; posterior angles rectangular; anterior margin broadly, arcuately emarginate; base transversely truncate to near middle of elytron, then feebly sinuate and turning obliquely backward to the scutellum, in front of which it is subtruncate; surface broadly and rather deeply depressed at the sides, the depression becoming gradually broader posteriorly and extending internally to the elytral lobe, sparsely and rather coarsely punctate, the punctures round and deep on the disk and stelliform in the depressions; intervals smooth on the disk, but becoming finely reticulate-striolate at the sides. Scutellum smooth and broadly triangular. Elytra moderately convex, as wide as pronotum at base, widest at about basal third; humeral angles rather obtusely angulated; sides feebly expanding to basal third, then strongly, arcuately attenuate to the tips, which are conjointly narrowly rounded, the lateral margins entire; humeri moderately developed; each elytron with a broad, deep depression at the base, and a narrow one between the humerus and lateral margin extending along the margin from the humeral angle to the middle and becoming much broader behind the humerus; surface feebly wrinkled at sides and humeral regions, coarsely, irregularly, and rather densely punctate; intervals entirely smooth. Abdomen beneath finely and obsoletely punctate, with a few inconspicuous hairs; intervals finely and densely reticulate-striolate, with a few long, widely separated rugae on the first segment; last segment broadly rounded at apex. Prosternum nearly smooth, with a few widely separated punctures; anterior margin feebly, arcuately emarginate. Metasternum sparsely and coarsely punctate; intervals smooth on anterior part, but becoming densely and finely reticulate-striolate on balance of surface.

Length, 2.75 mm.; width, 1.6 mm.

Type locality.—Paraiso, Canal Zone, Panama.

Other localities.—Porto Bello, Panama.

Type and *paratype.*—Cat. No. 25127, U.S.N.M.

Described from two specimens. The type was collected by E. A. Schwarz April 29, 1911, and the paratype by the same collector March 10, 1911.

This species is allied to *crassa* Waterhouse, but it does not have the pronotum transversely impressed at the base, and the posterior angles are rectangular, and not acute and directed backward as in *crassa*.

LEIOPLEURA SUBOPACA, new species.

Oblong, moderately convex, broadly rounded in front, broadly attenuate posteriorly, and slightly narrower behind than in front, subopaque; head and pronotum dull, dark green; scutellum piceous; elytra dark cyaneous; beneath piceous.

Head feebly convex and broadly depressed on the front, the depression deep on the front, but becoming obsolete on the vertex, with a distinct narrow, longitudinal groove extending from the epistoma to a small, obscure fovea on the front; surface coarsely, irregularly, and sparsely punctate; intervals densely and finely reticulate-striolate; antennae rather short and piceous, with a slight aeneous tinge. Pronotum moderately convex, three times as wide as long, narrower in front than behind, widest at base; sides nearly parallel to basal third, then strongly, arcuately attenuate to anterior angles; posterior angles feebly projecting and rather acute; anterior margin broadly, arcuately emarginate; base feebly, transversely sinuate to near middle of elytron, then feebly, arcuately emarginate for the elytral lobe, and turning obliquely backward to the scutellum, in front of which it is truncate; surface broadly and rather deeply depressed at the sides, the depression broader and obsoletely triangular at base and extending internally to the elytral lobe, sparsely punctate, the punctures very shallow and stelliform; intervals finely and densely reticulate-striolate, the striolation denser and coarser at the sides. Scutellum finely reticulate and broadly triangular. Elytra moderately convex, as wide as pronotum at base; humeral angles broadly rounded; sides nearly parallel to middle, then strongly, arcuately attenuate to the tips, which are separately and rather acutely rounded, the lateral margins obsoletely serrate; humeri rather prominent; each elytron with a rather broad, deep depression at the base, and narrow one between the humerus and lateral margin, extending along the margin from the humeral angle to behind the humerus, where the depression is much broader; surface feebly wrinkled at the sides, coarsely, irregularly, and rather densely punctate, the punctures shallow, and becoming obsolete behind the middle; intervals finely and densely reticulate-striolate. Body beneath sparsely punctate, the punctures rather obsolete on the abdomen, but becoming coarser on rest of surface; intervals densely and rather coarsely reticulate-striolate, with a few long, widely separated rugae on the anterior part of the first abdominal segment. Abdomen very sparsely clothed with inconspicuous hairs, and the last segment broadly rounded at apex; prosternum with the anterior margin feebly, arcuately emarginate.

Length, 2.9 mm.; width, 1.6 mm.

Type locality.—Paraiso, Canal Zone, Panama.

Type.—Cat. No. 25128, U.S.N.M.

Described from a single specimen collected by E. A. Schwarz March 26, 1911.

This species is very closely allied to *bicolor* Fisher, but differs from that species in being subopaque, the head and pronotum of a different shade of green, and the surface densely reticulate-striolate and not smooth at the middle, as in *bicolor*.

LEIOPLEURA INTERMEDIA Waterhouse.

Leiopleura intermedia WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 154, pl. 9, fig. 1.

This species was described from material collected by Mr. Champion at Cerro Zunil, Guatemala, at an altitude of 4,500 feet. This is a rather broad, depressed species, with the sides of the elytra subparallel for two-thirds their length, and then broadly attenuate to the apex. The type is in the British Museum and has not been examined, but the species is given its position in the key from the characters given in the original description.

LEIOPLEURA BELTII Waterhouse.

Leiopleura beltii WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1897, p. 666.

This beautiful species was described from Chontales, Nicaragua. It has the head and pronotum golden green, and the elytra of a bright, shining, coppery color, and which is differently colored from all the other species of the genus, except *buscki*, from which it differs by the characters given in the key and description. It is not represented in the National Museum Collection, but it is placed in the key from the characters given in the original description.

LEIOPLEURA BUSCKI, new species.

Ovate, moderately convex, broadly rounded in front, broadly attenuate posteriorly, and slightly narrower behind than in front, strongly shining; head and pronotum dark green, the latter with an obscure, dark, triangular area on the disk; scutellum brown, with a cupreous tinge; elytra bright coppery-red, with the sides for a short distance behind the humeral angles narrowly margined with violet, then becoming aureous posteriorly; beneath piceous.

Head nearly flat and broadly, obsoletely depressed on the front, with a rather obsolete, narrow, longitudinal groove extending from the epistoma to a large oblong fovea on the front; surface finely, irregularly, and very sparsely punctate; intervals smooth; antennae rather long and strongly aeneous. Pronotum rather strongly convex three times as wide as long, distinctly narrower in front than behind, widest at base; sides strongly, arcuately attenuate from base to anterior angles; posterior angles feebly projecting and rather acute;

anterior margin broadly, arcuately emarginate; base transversely truncate to near middle of elytron, then feebly sinuate and turning obliquely backward to the scutellum, in front of which it is truncate; surface strongly flattened at the sides (very narrowly at the middle), but feebly expanding to the anterior angles; posteriorly the depression is very broad and deep, extending internally as far as the basal depressions on the elytra, these depressions causing a subarcuate elevation at the middle extending from the disk to near the lateral margin, sparsely punctate, the punctures rather coarse on the disk, but becoming obsolete toward the sides; intervals nearly smooth, but becoming finely and obsoletely reticulate-striolate in the depressions. Scutellum smooth and broadly triangular. Elytra rather strongly convex, as wide as pronotum at base, widest at middle; humeral angles obtusely angulated; sides feebly sinuate at basal third, slightly, arcuately rounded at middle, then strongly, arcuately attenuate to the tips, which are rather subtruncate, the lateral margins entire; each elytron with a broad, obsolete depression at the base, and a deep, narrow one between the humerus and lateral margin, extending along the margin from the humeral angle to the middle and becoming broader behind the humerus; humeri rather prominent; surface slightly wrinkled at the sides, and coarsely punctate, the punctures widely separated and arranged in rows, and becoming more obsolete toward the apex; intervals finely and sparsely punctured. Abdomen beneath finely and obsoletely punctate, the intervals finely and densely reticulate-striolate, except on the first segment, where the surface is rugose, the rugae coarse and widely separated; last segment broadly rounded at apex. Prosternum finely and very sparsely punctated; intervals smooth: anterior margin truncate. Metasternum with a few very coarse punctures at the middle, and with coarse, widely separated rugae at the sides.

Length, 3.25 mm.; width, 2 mm.

Type locality.—Trinidad River, Panama.

Type and *paratype.*—Cat. No. 25129, U.S.N.M.

Described from two specimens collected by August Busck March 25, 1912.

LEIOPLEURA DIVISA Waterhouse.

Leiopleura divisa WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 155.

Described from material collected by Mr. Champion at Volcan de Chiriqui, Panama, at an altitude of 2,500 feet. It is not represented in the National Museum Collection, and has been placed in the key from the characters given in the original description.

LEIOPLEURA BASALIS Waterhouse.

Leiopleura basalis WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, pp. 158–159.

Described from material collected by Mr. Champion at Volcan de Chiriqui, Panama, at an altitude of 2,500 feet. It is not represented in the National Museum Collection, and has been placed in the key from the characters given in the original description.

LEIOPLEURA PUNCTICEPS Waterhouse.

Leiopleura puncticeps WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, pp. 156–157.

This species was described from material collected at Acapulco in Guerrero, Teapa in Tabasco, Mexico; Panima, San Juan, and Chacoj in Vera Paz, Guatemala; and Bugaba, Panama, without designating any definite type locality. From the description this species is quite variable in color and markings. It has not been seen by the writer, and is placed in the key solely upon the characters given in the original description.

LEIOPLEURA VENUSTA Waterhouse.

Leiopleura venusta WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, pp. 157–158.

The type of this species was collected at Volcan de Chiriqui, Panama, at an altitude of 3,500 feet. Waterhouse also records two other specimens which vary in the arrangement of the markings on the elytra, one of which was collected at San Geronimo, Guatemala, and the other at Cerro Zunil, Guatemala, at an altitude of 4,000 to 5,000 feet. There is a specimen in the National Museum Collection, collected at Porto Bello, Panama, April 18, 1912, by August Busck, which differs from the typical form by having the posterior green fascia covering the entire apical fifth of the elytra, but otherwise corresponds to the description given for this species.

LEIOPLEURA INTERRUPTA Waterhouse.

Leiopleura interrupta WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 158.

This species was described from material collected by Mr. Champion at Bugaba, Panama. The type is in the British Museum, and has not been examined. It has been placed in the key from the characters given in the original description.

LEIOPLEURA PULCHRA Waterhouse.

Leiopleura pulchra WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 156, pl. 9, fig. 4.

This species was described from material collected by Mr. Champion at Volcan de Chiriqui, Panama, at an altitude of 2,000 to 3,000 feet.

The type, which is in the British Museum, has not been examined; the species has been given its position in the key on the basis of the original description.

LEIOPLEURA LONGULA Waterhouse.

Leiopleura longula WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, pp. 162–163.

Described from material collected by Sallé at Cordoba, Mexico. The species is more elongate than *polita*, and strongly attenuate posteriorly. It is not represented in the National Museum Collection, but is placed in the key from the characters given in the original description.

LEIOPLEURA VIRIDIFRONS Waterhouse.

Leiopleura viridifrons WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 156.

The type locality of this species is Volcan de Chiriqui, Panama, and was collected by Mr. Champion at an altitude af 5,000 feet. The species is unknown to the writer, and it is placed in the key from the characters given in the original description.

LEIOPLEURA AENEIFRONS Waterhouse.

Leiopleura aeneifrons WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 160.

This species was described from material collected by Mr. Champion at Volcan de Chiriqui, Panama, at an altitude of 2,500 feet. It is one of the elongate and rather slender species; the pronotum has the sides nearly parallel at the basal half, and the elytra is gradually attenuate from the base to the apex. The species is not represented in the National Museum Collection, but has been given its position in the key solely upon the characters given in the original description.

LEIOPLEURA ATTENUATA, new species.

Oblong, moderately convex, broadly rounded in front, strongly attenuate posteriorly, and distinctly narrower behind than in front, moderately shining; head blue, with the anterior margin greenish; pronotum, scutellum, and elytra strongly aeneous, the pronotum narrowly margined on the sides and behind the basal depressions with green; beneath piceous.

Head moderately convex, and very feebly longitudinally depressed on the front, the depression becoming obsolete near the epistoma and on the vertex, and in the bottom of which is an obscure, longitudinal groove with a distinct oblong fovea at the middle: surface sparsely and irregularly punctate, the punctures coarser and denser on the occiput, but becoming more obsolete on the front; intervals densely and coarsely granulated, which nearly obscures the punctation; antennae rather short and piceous, with the basal joints slightly greenish. Pronotum moderately convex, two times as wide as long, narrower in front than behind, widest at base; sides nearly parallel to apical third, then arcuately attenuate to anterior angles; posterior angles distinctly projecting and rather acute; anterior margin feebly, arcuately emarginate; base transversely sinuate to middle of elytron, then turning obliquely backward to the scutellum, in front of which it is obsoletely sinuate; surface narrowly depressed along the sides, and with a broad, transverse, concave depression along the base, with an obsolete sinuate lateral carina extending from the base to middle, and nearly parallel to the lateral margin, finely and sparsely punctate, the punctures very shallow and stelliform; intervals finely, obsoletely punctate, and obscurely reticulate, becoming densely and coarsely granulate-striolate in the green areas at sides. Scutellum smooth and triangular. Elytra feebly convex, slightly narrower at base than pronotum; humeral angles obtusely angulated; sides feebly sinuate behind humeri, slightly expanded at middle where they are equal in width to the base, then strongly, arcuately attenuate to the tips, which are conjointly narrowly rounded, the lateral margins rather strongly serrate; humeri moderately developed, and extending nearly to the lateral margin; each elytron with a broad, rather deep depression at the base, and a broad, shallow one along the lateral margin behind the humerus; surface feebly wrinkled near the base, coarsely, irregularly, and rather densely punctate, the punctures somewhat confused at the humeral regions, but becoming more obsolete toward the apex; intervals smooth. Abdomen beneath densely and finely reticulate-striolate, with a few long, widely separated rugae on the first segment; last segment broadly rounded at apex. Prosternum sparsely punctate, the punctures obsolete anteriorly, but becoming very coarse on the prosternal process; anterior margin truncate. Metasternum sparsely, obsoletely punctate, with the intervals densely reticulate-striolate, and with long, widely separated rugae on the median part.

Length, 2.75 mm.; width, 1.25 mm.

Type locality.—La Ceiba, Honduras.

Type and *paratypes.*—Cat. No. 25130, U.S.N.M.

Described from four specimens collected by F. J. Dyer August 23, 1916.

This species is rather variable in color. Paratype "a" is more violaceous on the elytra than the type; paratype "b" has the head cupreous, with a strong violaceous tinge on the occiput, pronotum without the green margins, and the entire upper surface strongly violaceous; paratype "c" has the head green, pronotum without the green margins, and the entire upper surface more piceous than in the type.

LEIOPLEURA INAEQUALIS Kerremans.

Leiopleura inaequalis KERREMANS, Ann. Soc. Ent. France, vol. 63, 1894, p. 428.

Described from material collected in the refuse of tobacco imported into Paris, France, from Mexico. The species is unknown to the writer, and it has been placed in the key from the characters given in the original description.

LEIOPLEURA DIFFICILIS Waterhouse.

Leiopleura difficilis WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 161.

This species was described from material collected by Mr. Champion at Caldera in Chiriqui, Panama, at an altitude of 1,200 feet. Waterhouse also records a specimen from Belize, British Honduras, which varies slightly from the type in not having the transverse wrinkles on the elytra. The type is in the British Museum and has not been examined. It is placed in the key on the basis of the original description.

LEIOPLEURA NITIDICOLLIS Kerremans.

Leiopleura nitidicollis KERREMANS, Ann. Soc. Ent. France, vol. 63, 1894, pp. 423–424.

Described from material collected in the refuse of tobacco imported into Paris, France, from Mexico. The species is unknown to the writer, and it has been placed in the key from the characters given in the original description.

LEIOPLEURA LEVIS Kerremans.

Leiopleura levis KERREMANS, Ann. Soc. Ent. France, vol. 63, 1894, pp. 422–423.

Described from material collected in the refuse of tobacco imported into Paris, France, from Mexico. The species is unknown to the writer, and it has been placed in the key solely upon the characters given in the original description.

LEIOPLEURA LATERALIS Waterhouse.

Leiopleura lateralis WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, pp. 159–160.

This species was described from material collected by Mr. Champion at Volcan de Chiriqui, Panama, at an altitude of 3,500 feet. It is represented in the National Museum Collection by a specimen collected by E. A. Schwarz at Paraiso, Canal Zone, Panama, on January 16, 1911.

LEIOPLEURA PLACIDA Waterhouse.

Leiopleura placida WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, 1889, p. 163.

This species was described from material collected by Mr. Champion at Volcan de Chiriqui, Panama, at an altitude of 2,500 feet. It is not represented in the National Museum Collection and is unknown to the writer. The species is placed in the key on the basis of the original description.

LEIOPLEURA PURPUREIPENNIS, new species.

Broadly ovate, feebly convex, slightly longer than wide, broadly rounded in front, and nearly as broadly rounded posteriorly, moderately shining; head and pronotum bright green, the latter with a broad piceous area on the disk; scutellum piceous; elytra dark purple, with the sides narrowly margined with violet; beneath piceous.

Head nearly flat and broadly depressed on the front, the depression very deep near the epistoma, but becoming obsolete on the vertex, with a distinct, narrow, longitudinal groove extending from the epistoma to the vertex; and with a large, oblong fovea on the front situated in the median groove; surface coarsely and rather densely punctate; intervals densely and very coarsely vermiculate-striolate, which nearly obscures the punctation; antennae rather short and entirely piceous. Pronotum evenly convex, three times as wide as long, considerably narrower in front than behind, widest near base; sides arcuate to near middle, then strongly, arcuately attenuate to the anterior angles; posterior angles nearly rectangular; anterior margin deeply, arcuately emarginate; base transversely truncate to near middle of elytron, then abruptly, arcuately emarginate and turning obliquely backward to the scutellum, in front of which it is truncate; surface with the lateral margins slightly elevated, and the dark, median area covering one-third of the surface, with the anterior angles rounded, sparsely and rather coarsely punctate; intervals nearly smooth on the dark area, but densely and coarsely vermiculate-striolate on the green areas, the striolation nearly obscuring the punctation. Scutellum finely reticulate and very broadly triangular. Elytra feebly convex, as wide as pronotum at base; widest near the middle; humeral angles broadly rounded; sides feebly expanding to middle where they are broadly rounded, then strongly, arcuately attenuate to the tips, which are conjointly, broadly rounded, the lateral margins slightly elevated and obsoletely serrate; humeri rather prominent; each elytron with a broad, shallow depression at the base, and a narrow, deep one between the humerus and lateral margin, extending along the margin from the humeral angle to near the apex, broadly expanded behind the humerus, and with a broad, obsolete depression near the apex; surface coarsely, irregularly, and rather densely punctate, the punctures shallow and somewhat stelliform; intervals nearly smooth. Abdomen beneath sparsely and finely punctate, with a few very short, cinereous hairs; intervals finely and densely reticulate-striolate, with a few long rugae on the first segment; last segment very broadly rounded at apex. Prosternum finely and densely reticulate-striolate anteriorly, becoming much smoother, and with a few fine punctures on the prosternal process; anterior margin feebly, arcuately emarginate. Metasternum finely and densely reticulate-striolate, with a few coarse, widely separated rugae at the sides.

Length, 3.4 mm.; width, 2.3 mm.

Type locality.—Cordoba, Vera Cruz, Mexico.

Other locality.—Tuxtla, Mexico.

Type and *paratype.*—Cat. No. 25131. U.S.N.M.

Described from two specimens. The type was collected by Frederick Knab, April 1, 1909, and the paratype by O. W. Barrett.

This species is allied to *contigua* Waterhouse, but it is broader, antennae and femorae entirely black, and the green and black areas on the pronotum are more distinctly separated.

LEIOPLEURELLA, new genus.

Head wide in front, rather flat and longitudinally grooved; epistoma separated from the front by a deep, transverse groove, rather strongly constricted between the antennal cavities, which are narrowly separated, anterior margin truncate. Antennae short, inserted when at rest, in a long, deep groove in the prosternum; joints 1 and 2 globular, and about equal in length; third joint narrow and equal in length to the second; joints 4 to 10, shorter than the second, about equal in length, very compact, and becoming slightly wider anteriorly, the outer joints nearly square; last joint oblong and rounded at the apex. Eyes large, elliptical, and parallel on the front. Pronotum much wider than long, strongly convex, without a median groove or carina; base bisinuate. Scutellum large, triangular. Elytra strongly convex, subparallel, obsoletely depressed at base, strongly declivous posteriorly; lateral margins serrate posteriorly; surface not costate. Prosternum wide, flat, and broadly rounded at apex; anterior margin truncate. Metasternum broadly emarginate in front for the reception of the prosternal process. Body beneath rather flat. Posterior coxae narrow, rather strongly dilated internally and externally; anterior margin sinuate; posterior margin broadly concave. Legs free, but inserted in rather shallow depressions; femora rather robust, somewhat flattened, and strongly narrowed at the apex; tibiae slender and feebly arcuate; tarsi short, the joints about equal in length; claws with a broad tooth at base, which is nearly as long as the outer acute tooth.

Genotype.—*Leiopleurella splendida*, new species.

This genus is closely allied to *Callimicra* Deyrolle. It differs, however, from that genus in having the body beneath rather flat, epistoma truncate in front, pronotum evenly convex and not depressed at sides and along base, antennae compact, and the joints not triangular, and the eyes parallel. It is also allied to *Leiopleura* Deyrolle, from which it differs, by being more robust, parallel, and declivous posteriorly, front of head wider between the eyes, the antennae more compact, and the joints not triangular.

LEIOPLEURELLA SPLENDIDA, new species.

Form elongate, subparallel, strongly convex, broadly rounded in front, feebly attenuate posteriorly, and slightly narrower behind than in front; surface glabrous and strongly shining; head (except the anterior part which is piceous), pronotum, and scutellum cupreous, with a strong fiery-red reflection; elytra cyaneous; beneath piceous, with a feeble aeneous tinge.

Head flat on the vertex and occiput, feebly convex behind the epistoma, with a rather broad, shallow depression on the front, the depression becoming narrow and obsolete on the vertex and occiput; surface rather sparsely and irregularly punctate, the punctures large, deep, and widely separated; intervals obsoletely reticulate-striolate on the vertex and occiput, the striae becoming more distinct behind the epistoma; antennae piceous, with a slight aeneous tinge, very short, reaching a little beyond the anterior angles of the pronotum. Pronotum strongly, evenly convex, without any depressions, more than two times as wide as long at middle, distinctly narrower in front than behind, widest at the apical third; sides strongly arcuate from base to apical third, then more strongly, arcuately attenuate to the anterior angles, which are obtusely rounded; anterior margin deeply, arcuately emarginated for the insertion of the head; base nearly transversely truncate to middle of elytron, then feebly emarginate, and with a broadly rounded lobe in front of the scutellum; posterior angles obtusely rounded; surface deeply and irregularly punctate, the punctures widely separated on the disk, but becoming denser, much larger, and somewhat confluent at the sides; intervals finely and densely reticulate-striolate, the striae nearly obsolete on the disk, becoming more distinct toward the sides. Scutellum one and one-half times as wide as long; surface densely, obsoletely reticulate-striolate. Elytra strongly convex, slightly narrower then pronotum at base; humeral angles broadly rounded; sides nearly parallel to the apical third (feebly sinuate behind the humeri), then broadly, arcuately attenuate to the tips, which are conjointly broadly rounded; lateral margins strongly serrate posteriorly; each elytron with a broad obsolete depression at the base, and a similar one behind the humerus; surface sparsely and irregularly punctate, the punctures rather deep and coarse at the base, but becoming finer toward the apex; intervals widely, obsoletely reticulate-striolate on the disk, becoming strongly rugose and finely granulated at the sides. Abdomen beneath sparsely, finely, and obsoletely punctate; intervals finely and densely reticulate-striolate; last segment broadly rounded posteriorly, with two sharp, widely separated spines at the apex. Prosternum finely transversely striolate anteriorly; prosternal process nearly smooth, with a few widely separated punctures.

Length, 4.75 mm.; width, 2.75 mm.

Type locality.—Trinidad River, Panama.

Type.—Cat. No. 25132, U.S.N.M.

Described from a unique specimen collected at Trinidad River Panama, June 2, 1912, by August Busck.

Tribe MASTOGENINI LeConte and Horn.

Mastogenini LeConte and Horn, Classification of the Coleoptera of North America, Smiths. Misc. Coll., vol. 26, No. 507, 1883, pp. 199–200.

This is a very small tribe and contains only five described genera, two of which have been found within the area covered by the present paper. All of the known genera are included in the key, since *Micrasta* described by Kerremans from Brazil, and *Trigonogya* described by Schaeffer for a single species from Brownsville, Texas, may be found in Mexico and Central America in the near future. The genus *Ankareus* was erected by Kerremans for a number of species found in Madagascar.

The species of this group have the body somewhat cylindrical, nearly parallel, and scarcely narrowed behind. The front of the head is rather strongly narrowed by the insertion of the antennae; antennal cavities large and situated a certain distance from the eyes; base of pronotum truncate; sternal cavities for the insertion of the prosternal process, formed entirely within the metasternum, the mesasternum being scarcely visible; hind coxae scarcely dilated internally; tarsal claws broadly toothed.

So far, very little is known about the habits of any of the species of this group. Burke[9] records *Mastogenius* as a twig-borer in fire-killed saplings of Spanish oak (*Quercus digitata*) in the Southern States, but none of the larvae were collected.

KEY TO THE GENERA.

1. Prosternum with distinct antennal cavities, and a carina on each side of middle. **Trigonogya** Schaeffer.
Prosternum without antennal cavities or carina at middle.................... 2
2. Eyes a little oblique, slightly converging on the occiput.................... 3
Eyes parallel.................... 4
3. Antennae serrate from the fourth joint.................... **Mastogenius** Solier.
Antennae serrate from the third joint.................... **Ankareus** Kerremans.
4. Antennae with the serrate joints triangular.................... **Micrasta** Kerremans.
Antennae with the joints elongate, and scarcely serrate on the inner side. **Exaesthetus** Waterhouse.

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[9] U. S. Dept. Agri., Bull. No. 437, 1917, p. 7.

Genus MASTOGENIUS Solier.

Mastogenius Solier, Gay's Hist. Chile, Zool., vol. 4, 1849, pp. 507–508.

This genus contains 13 species, 1 of which is described as new in the present paper. Of the previously described species, 5 are found in the United States, 5 in South America, 1 in the West Indies, and 1 in Africa; the latter may not be congeneric with the species found in America.

MASTOGENIUS CYANEOUS, new species.

Elongate, subparallel, uniformly dark blue above, except the scutellum, which is piceous; beneath piceous.

Head convex, without any median depression; surface rather densely, deeply, and coarsely punctate, with the intervals finely, reticulate; eyes distinctly closer on the occiput; antennae reaching to middle of pronotum, serrate from the fourth joint, second joint short, globose, third joint about as long but much narrower than the second, slightly shorter than the fifth, and scarcely half as long as the fourth. Pronotum regularly convex, about one and one-half times as wide as long, distinctly narrower in front than behind, widest at the middle, sides feebly arcuate from base to apical fourth, then strongly, arcuately converging to the anterior angles; posterior angles feebly obtuse; anterior margin feebly, arcuately emarginate when viewed from above; base truncate; surface densely and coarsely punctate similar to that of the head, the punctures deep and regularly placed, and from each arises a very fine, rather long, recumbent hair: intervals finely reticulate. Scutellum ogival form, smooth. Elytra strongly convex, as wide as pronotum at base; sides nearly parallel to apical third, then arcuately attenuate to near the apex, where they are feebly sinuate, the tips strongly gibbose, and separately, broadly rounded; humeral angles obtusely rounded; surface with a deep transverse depression at the base, and a broadly obsolete one behind the humeri, rather coarsely punctate, and with the punctures a little more widely separated, and the pubescence finer and more obsolete than on the pronotum; intervals nearly smooth. Abdomen beneath strongly convex, sparsely, finely punctate and sparsely clothed with short, recumbent, cinereous hairs; intervals finely reticulate; last segment broadly rounded at apex. Prosternum and metasternum coarsely and rather densely punctate, the punctures very deep and well separated on the prosternal process; prosternum without antennal cavities. Posterior margin of hind coxal plate feebly sinuate.

Length, 2.75 mm.; width, 1.75 mm.

Type locality.—Ancon, Canal Zone, Panama.

Type.—Cat. No. 25133, U.S.N.M.

Described from a single specimen collected by E. A. Schwarz, May 5, 1911.

This is the first species of this genus to be described from Central America, although the species of this genus extends from the United States into South America. When these small and apparently rare insects are better known, there probably will be a number of species found in Central America and Mexico.

Genus EXAESTHETUS Waterhouse.

Exaesthetus WATERHOUSE, Biol. Centr.-Amer. Coleopt., vol. 3, pt. 1, Suppl., 1889, pp. 192-193, pl. 9, figs. 15, 15*a–e*.

Only one species is described in this genus and, as it is unknown to the writer, a copy of the original description is given in full.

Antennal sockets small, not very approximate. The antennae a little longer than the head and thorax together, hairy; the first and second joints moderately large, the following ones slender, elongate (Tab. ix, fig. 15*a*). Thorax convex, transversely impressed at the base, finely margined at the sides, the anterior angles deflexed and not visible from above. Scutellum elongate, arcuately acuminate (fig. 15*b*). Elytra as broad as the base of the thorax, subparallel, arcuately narrowed at the apex, without costae. Prosternum without chin piece; the intercoxal process subquadrate, obtusely rounded at the apex, almost truncate, and met posteriorly by a slight projection of the metasternum. Metathoracic episterna moderately wide, subparallel. Posterior coxae of nearly equal width throughout (fig. 15*c*). Abdomen with the first and second segments united into one; the intercoxal process acuminate. Legs rather slender; the tibiae straight; the tarsi moderately long, the second and third joints with a very small lamina, which is scarcely distinguishable when dry, the fourth joints with a rather large, delicate lamina; the claws dilated at their basal half (figs. 15*d*, *e*).

I think this very abberant Buprestid may be placed next to *Mastogenius*. Its general appearance is suggestive of *Haplocnemus* in the Dasytidae.

EXAESTHETUS DASYTOIDES.

Elongatus, paullo convexus, nitidus, subtus fere niger, supra nigrescentiaeneus; capite leviter convexo, sat crebre subtiliter punctato; thorace antice angustato, convexo, sat crebre evidenter punctato, lateribus sat rotundatis; elytris sat crebre fortiter punctatis. Long. 2 lin.

Hab. Mexico, Jalapa (Höge).

The head has an impression in the middle of the lower part of the face. The thorax is impressed at the base, convex on the disk; the punctures are very distinct, rather close together. The elytra have the punctures rather strong and moderately close together.

MINERALOGIC NOTES ON PUCHERITE, PYRITE, TRICHALCITE, AND WAVELLITE.

By Earl V. Shannon,
Assistant Curator of Geology, United States National Museum.

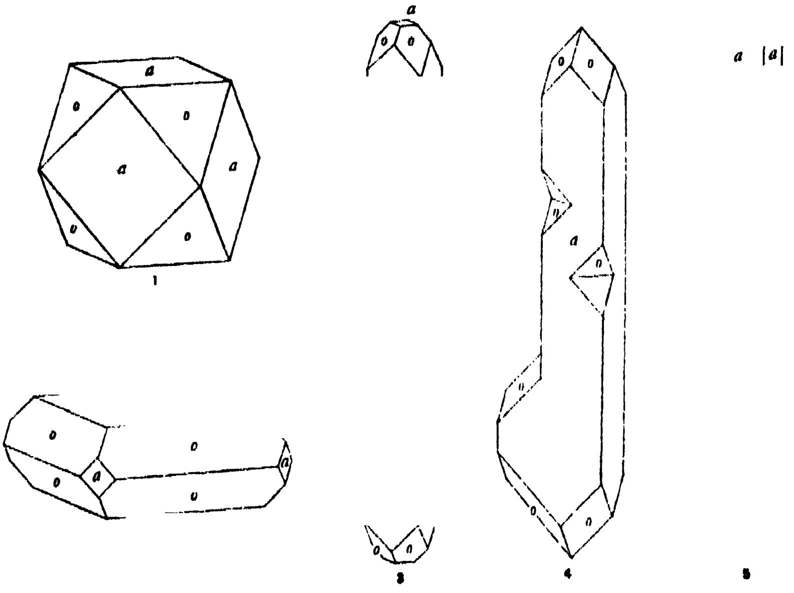
INTRODUCTION.

Minor investigations are constantly being conducted in this laboratory for the necessary purpose of accurately ascertaining the mineralogic identity of materials. These may be specimens submitted for identification by correspondents, they may be new and unlabeled material to be placed upon exhibition or filed with the reference collections, or they may be specimens already incorporated in the collections whose labeling is found to require confirmation or correction. These investigations may be conducted by chemical, optical, or crystallographic methods or a combination of these as the case may require. Almost invariably new facts of importance are developed by these studies, and it is desirable that the results be published, firstly in order to permanently record the evidence upon which the specimen is labeled and secondly because the new data furnished in regard to the properties or occurrence of rare and unusual minerals are of interest and value to mineralogical science in general.

It is a practice previously inaugurated in this department to combine several of these minor researches, even when they are not directly related to each other, into a paper of convenient length for publication in the Museum Proceedings. In the present contribution there are assembled short papers on four different subjects: Pyrite crystals of unusual crystallographic development from Arkansas, Pucherite from a new locality in Brazil in measurable crystals agreeing with those previously recorded on European material and showing one new form, Trichalcite from a new locality in Idaho having optical properties agreeing with those of the mineral from the original locality and showing measurable crystals which add new information regarding the crystallography of this rare arsenate, and Crystallographic and optical properties of wavellite crystals of two specimens from Montgomery County, Ark.

UNUSUAL PYRITE CRYSTALS FROM ARKANSAS.

A specimen recently received for examination from Mr. C. A. McClelland of Stillwater, Ark., contains pyrite crystals of such unusual development as to merit a brief description. The crystals are small, averaging less than a millimeter in diameter, and are attached to the faces of imperfect quartz crystals which line vuggy cavities in white quartz. The quartz forms veins up to 2 inches thick in a black highly graphitic slate. No other minerals are associated with the pyrite. The crystals all show the simple combination of cube *a*(100) and octahedron *o*(111) both prominently developed. Their claim to distinction lies in their unsymmetrical development. Many of the crystals are cuboctahedrons of normal proportions. (Fig. 1.) From this habit they vary to long prismatic with the length 10 to 20 times the diameter as illustrated in Figure 3, the apparently tetragonal prism being formed by the vertical faces of the cube, while the octahedral planes form a terminal pyramid, often truncated at its summit by a minute cube face. The faces are practically perfect and free from striations, although some of the long prisms taper slightly, as indicated by the following angular measurements, which were made on a crystal of the habit illustrated in Figure 3.



Figs. 1-5.—Pyrite crystals from Stillwater, Ark.

Measurements on elongated pyrite crystal from Arkansas.

No.	Form.	Reflections.	Measured.		Calculated.	
			φ	ρ	φ	ρ
			° ′	° ′	° ′	° ′
1	*a* (100)	Very good	0 00	89 16	0 00	90 00
2	*a* (100)	Poor, blurred, two signals	0 28	89 17	0 00	90 00
3	*a* (100)	Very good	0 00	89 25	0 00	90 00
4	*a* (100)	Good	0 19	89 25	0 00	90 00
5	*a* (001)	Minute, reflection only	....	0 00	....	0 00
6	*o* (111)	Excellent	45 00	54 47	45 00	54 44
7	*o* (111)	Good	44 52	54 39	45 00	54 44
8	*o* (111)	Fair	45 10	54 39	45 00	54 44
9	*o* (111)	Good	44 45	54 39	45 00	54 44

In the other direction the crystals are flattened into moderately thin square tables of the habit illustrated in Figure 2. A crystal showing one of the numerous variations of the elongated cuboctahedrons is illustrated in Figure 4. Not uncommonly crystals of moderate elongation are aligned into strings of individuals in parallel position as shown in Figure 5. Occasionally scepter crystals are thus formed by an equidimensional individual being perched atop a long prism.

Variously elongated crystals of pyrite have been described from a number of localities, but crystals of such extreme deviation from normal symmetrical development are by no means common. Whitlock[1] has figured greatly elongated cubes occurring in or with calcite and dolomite, from Rondout, Ulster County, N. Y. One of the illustrated crystals showed small octahedral planes and was thus very similar to those from Arkansas here described. Some of the New York crystals were twinned on the spinel law, giving unusual T and L shaped forms, and the terminal individuals of scepter crystals were oriented in twinned position. No definite twins could be found in the Arkansas specimen, certain pairs simulating twins being found to be only in accidental contact.

The distorted octahedra from French Creek, Pa., described by Penfield,[2] are very different from these elongated individuals.

PUCHERITE FROM MINAS GERAES, BRAZIL.

A specimen (Cat. 94221) which has recently been received by the Museum from Mr. J. E. Carney, jr., through Mr. F. L. Hess, was identified by Mr. Hess as pucherite, the rare bismuth vanadate. Crystallographic measurements confirm Mr. Hess's identification.

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[1] Herbert P. Whitlock. Bull. New York State Museum No. 98, p. 6, 1905.

[2] S. L. Penfield. On some curiously developed pyrite crystals from French Creek, Delaware County, Pa. Amer. Journ. Sci., vol. 37, p. 209, 1899.

Pucherite has not heretofore been reported from Brazil and, since the crystal measured shows one form new to the mineral, the results are presented briefly. Crystallized pucherite has previously been known only from Europe, although earthy and pulverulent material has been found in Arizona and California.

The present specimen is from a weathered pegmatite vein in Sao Jose de Bryauba in the Province of Minas Geraes, Brazil. The specimen consists of a mass of pale yellow earthy bismutite which has a faintly woody structure, as though pseudomorphous after some columnar mineral. The exterior of the specimen is partly coated with the crystalline pucherite, while some pucherite is also disseminated through the interior of the bismutite mass. The pucherite is dull dark brownish red in color and forms crusts of imperfect, intergrown, and somewhat bruised crystals. Only one crystal was measured, and very few of those on the specimen are suitable for measurement. The crystal measured had the form shown in orthographic and clinographic projections in Figure 6. The dominant planes are, as shown, the base *c* (001) and the pyramid *e* (121), with *x* (021) and *k* (122) as smaller faces. The basal pinacoid *c* (001) gives an excellent signal, which serves to orient the crystal in polar position. The dome *x* (021) also gives very good signals, while the pyramid *e* (121) is wavy and striated parallel with its intersection with the base. The pyramid *k* (122) has not previously been recorded for this species. It occurs as relatively narrow faces giving only moderately good signals. The measurements on the crystal are tabulated below:

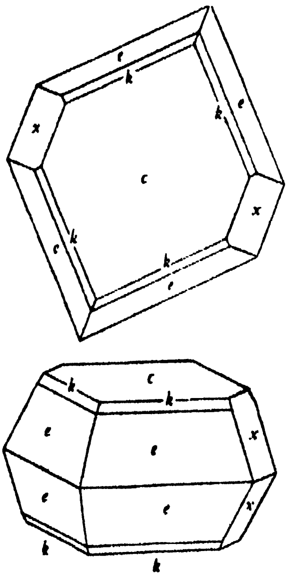


FIG. 6.—ORTHOGRAPHIC AND CLINOGRAPHIC DRAWINGS OF A PUCHERITE CRYSTAL FROM MINAS GERAES, BRAZIL.

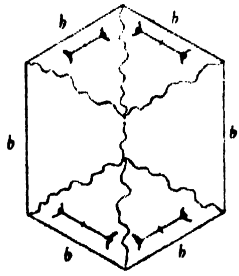
Forms and angles on pucherite from Brazil.

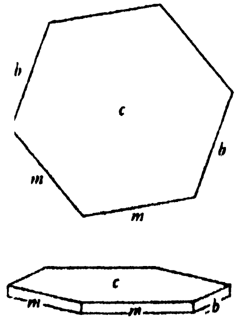
Letter.	Miller.	Symbol.	Measured.		Calculated.	
			φ	ρ	φ	ρ
			° ′	° ′	° ′	° ′
c	(001)	0	....	0 00	....	0 00
x	(021)	02	0 00	66 49	0 00	66 49
e	(121)	12	43 14	72 40	43 11	72 40
k	(122)	½1	43 34	58 49	43 11	58 01

TRICHALCITE FROM SHOSHONE COUNTY, IDAHO.

Some years ago the writer had occasion to visit the property of the Liberal King claim near the Lookout Mountain mine on the high mountain east of the Forks of Pine Creek in the Pine Creek district, Shoshone County, Idaho. The following account is abstracted from notes made at that time:

> The upper tunnel of this property has developed a vein 6 to 8 feet wide, striking N. 80° W. and dipping 80° southwest. This vein consists of porous quartz inclosing much wall rock. Disseminated in moderate amount through this quartz are sulphides, mainly pyrite with less chalcopyrite and arsenopyrite and occasionally a little galena and sphalerite. The porosity of the quartz seems to be an original condition and not due to the solution or removal of any primary constituent of the vein. Some coarse-grained galena was seen in a lens of quartz on the hanging wall side of the main vein. Percolating waters have largely decomposed the surfaces of the chalcopyrite and pyrite masses, depositing a sooty black secondary sulphide or oxide of copper. More intense oxidation has colored the porous quartz by the formation of brilliant yellow, blue, and green coatings of secondary minerals. On the hanging wall of the quartz vein there is a pronounced fissure having a thoroughly crushed gouge, which is made up entirely of country rock with no drag quartz. Distributed along this fissure are streaks of fine-grained brown sphalerite or finely intergrown sphalerite and galena up to several inches wide.





FIGS. 7-8.—7, OPTICAL AND CRYSTALLOGRAPHIC STRUCTURE OF TWINNED CRYSTAL OF TRICHALCITE. 8, ORTHOGRAPHIC AND CLINOGRAPHIC DRAWINGS OF SIMPLE TABULAR CRYSTAL OF TRICHALITE.

On the dump of this tunnel there was, at that time, a large pile of the quartzose vein material, which was very highly colored with the secondary minerals mentioned above. These had the appearance of arsenates, and specimens collected at that time gave qualitative reactions for arsenic. The bulk of the coatings was exceedingly small, however, and, as no facilities for detailed investigation were available, the specimens became lost without their minerals being definitely identified.

Recently a typical specimen of this material from the Liberal King claim has been forwarded to the National Museum by the United States Geological Survey as a part of the collection of Mr.

Edward L. Jones, jr., illustrating his work in this district.[3] The opportunity was thus offered for determining the mineralogical identity of the secondary arsenates which form the brilliant coatings.

The ore consists, as has been detailed above, of porous white quartz containing disseminated sulphides, including pyrite, chalcopyrite, and arsenopyrite, the latter in steel gray orthorhombic crystals. There is also some black sphalerite and perhaps a little enargite in the ore. The pyrite is partly coated by the black mineral, probably sooty chalcocite, and the quartz is brilliantly colored by thin films of a blue-green mineral with lesser amounts of a yellow-green to yellow mineral and an emerald-green crystalline one.

The most abundant of these, the blue-green mineral, has a vitreous to pearly luster and resembles tyrolite. It gave qualitative chemical reactions for copper and arsenic. At the request of the writer Mr. A. Rodolfo Martinez very kindly worked out the optical properties of this mineral, and by reference to Larsen's tables[4] it was found to agree with the rare arsenate trichalcite, as shown by the following comparison:

Comparison of optical properties of trichalcite.

Pine Creek, Idaho (Martinez).	Turginsk, Urals (Larsen).
Color pale bluish-green.	Color pale bluish-green.
Nonpleochroic.	Nonpleochroic.
Biaxial.	Biaxial.
Sign negative (−).	Sign negative (−).
2V large.	2V large.
$\alpha =$ ———.	$\alpha = 1.67 \pm 0.01$.
$\beta = 1.688$.	$\beta = 1.686 \pm 0.003$.
$\gamma =$ ———.	$\gamma = 1.698 \pm 0.003$.
Birefringence medium low.	Birefringence 0.028
X normal to plates.	X normal to plates.

There is no other known mineral containing copper and arsenic acid which approaches these properties and, while it is regrettable that the mineral is not available in quantity sufficient for analysis, its identity can be considered as established by these data.

Upon examination of the specimen under a binocular microscope it was found that the mineral was in thin tabular crystals of hexagonal aspect, and although these were very minute it was found possible to measure two of them on the 2-circle goniometer. The basal pinacoid gave good signals, but the very narrow prismatic planes were more or less curved and irregular, yielding only approximate measurements, accurate perhaps to 1°. These indicated 60° angles for the prismatic zone, the mineral thus simulating hexagonal crystallographic symmetry. Examination in polarized light of the measured crystals shows these to be twins, as shown in Figure 7, made up of biaxial orthorhombic sectors. The sectors have interlocking boundaries. Each sector has a well-defined cleavage parallel to its free edge, and the extinction is parallel to this edge. Each sector gives in convergent light a perfectly centered biaxial interference figure. The several apparently prismatic planes of the pseudo-hexagonal tablet thus are evidently pinacoids of the several orthorhombic units which go to make up the twinned group. This may indicate that the orthorhombic form is an inversion product which is pseudomorphous after an original hexagonal form, but it is more probable that it is merely characteristic of trichalcite to form repeated twins, with the twinning plane the unit prism (110), which are pseudo-hexagonal. This is characteristic of a great many orthorhombic minerals whose prismatic angle approaches the hexagonal angle, as, for example, aragonite, witherite, cerrussite, chalcocite, etc. Figure 8 is drawn to show, in orthographic and clinographic projections, a crystal which, while having the same tabular habit, is untwinned.

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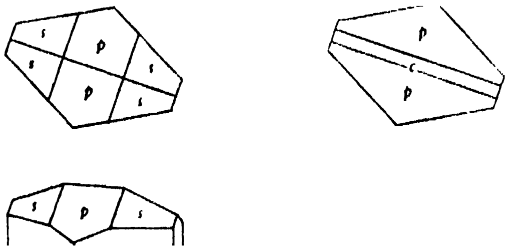
[3] Edward L. Jones, jr., A reconnaissance of the Pine Creek district, Idaho. U. S. Geol. Survey Bull. 710(a), pp. 1-36, 1919.

[4] Esper S. Larsen, jr., Microscopic determination of the nonopaque minerals. U. S. Geol. Survey Bull. 679, pp. 144 and 263, 1921.



FIGS. 9-10.—ORTHOGRAPHIC AND CLINOGRAPHIC DRAWINGS OF WAVELLITE CRYSTALS FROM ARKANSAS.

Trichalcite has previously been known only from the original locality in the Urals, the Idaho occurrence thus giving a second locality for this rare arsenate. The associated arsenates in the Idaho specimen have not been identified. These include a yellow-green material resembling scorodite and a green mineral resembling clinoclasite.

WAVELLITE CRYSTALS FROM ARKANSAS.

A specimen in the Museum collection (Cat. 45211) which shows minute white to brownish-white acicular crystals implanted singly and in groups over surfaces of gray-green variscite was labeled "natrolite on variscite." The specimen was received from Mr. Charles F. Brown and bore this label when received. The unusual association of a zeolite with a phosphate had not previously been noted, and this led to a preliminary optical examination which showed that the acicular crystals were not natrolite but were more probably tavistockite or wavellite. More detailed optical measurements made by Dr. E. S. Larsen indicated that, in all probability, the mineral was wavellite. The properties are as follows: Biaxial, positive (+), 2V medium large, ($\pm 60°$). Dispersion $\rho > v$ so small as to be doubtful. $Z = c$. No principal optical directions perpendicular to the prism faces. Refractive indices $\alpha = 1.525 \pm 0.003$, $\beta = 1.534 \pm 0.003$, $\gamma = 1.545 \pm 0.003$. Birefringence 0.020 ± 0.003. There are apparently three good cleavages normal to the principal optical directions.

In order that no question might remain regarding the identity of the material, such as could be spared without serious injury to the specimen was scraped off and examined chemically. Only 0.036 gram of pure material was available. This gave a loss on ignition of 30.09 per cent ($=H_2O+F$). The ignited mineral was fused with a large excess of sodium carbonate and the fusion leached with boiling water. The residue of insoluble material consisted of 0.0022 gram of Fe_2O_3, possibly largely derived from reagents. It contained no lime. The filtrate gave abundant reactions for alumina and phosphoric acid.

Although the crystals were very minute, averaging perhaps ½ mm. in length and one-fifth to one-tenth this in diameter, it was found possible, after several trials, to secure one which gave satisfactory measurements on the 2-circle goniometer. Since, as pointed out by Wherry,[5] the axial ratios of wavellite are probably variable and are not accurately known beyond the third decimal place, the angles measured were used to calculate axial values for the best crystal measured from the Arkansas specimen. The measurements gave as follows:

Form.	Measurements.		Difference.		Average.	
	φ	ρ	φ	ρ	φ	ρ
	° ′	° ′	° ′	° ′	° ′	° ′
p (101)	89 55 90 03	36 10 36 10	0 08	0 00	89 59	36 10
		gives $p_0 = 0.7310$				
s (111)	60 26 60 15 60 33 60 40	40 06 40 18 40 14 40 01	0 25	0 17	60 28½	40 10
		gives $p_0 = 0.7344$				

The values for p_0 derived from the two forms are not in satisfactory agreement; and since the faces of neither form gave conspicuously superior measurements, it is necessary to take the mean value for p_0, namely 0.7327. With this value assumed, the forms $s(111)$ and $m(110)$ yield for q_0 the values 0.4161 and 0.4112, respectively. Again, it is necessary to adopt the average of two values, and the axial values obtained for the crystal are as follows:

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[5] Edgar T. Wherry. Notes on mimetite, thaumasite, and wavellite. Proc. U. S. Nat. Mus., vol. 54, pp. 373-381, 1918.

$p_0 = 0.7327$ $\quad$ $a = 0.5645$
$q_0 = .4136$ $\quad$ $c = .4136$

The above value for the a axis is practically identical with that of Wherry for the Pennsylvania material ($a = 0.5640$), while the c axis is somewhat greater than Wherry's ($c = 0.4040$). The present examination merely adds another observation to the four or five already available.

In habit the crystals of the Arkansas specimen are not unusual, as shown in Figure 9, the forms being $b(010)$, $m(110)$, $p(101)$, and $s(111)$, all prominently developed. There is a tendency for the crystals to aggregate in almost parallel position or in sheaves. The prismatic faces are slightly striated vertically. The angles measured on the only really satisfactory crystal examined are below compared with the angles calculated from the above derived values for the axes:

Calculated and measured angles of wavellite.

Letter.	Miller.	Symbol.	Measured.		Calculated.	
			φ	ρ	φ	ρ
			° ′	° ′	° ′	° ′
b	(010)	∞0	0 06	90 00	0 00	90 00
b	(010)	∞0	0 06	90 00	0 00	90 00
m	(110)	∞	60 47	90 00	60 33	90 00
m	(110)	∞	60 46	90 00	60 33	90 00
m	(110)	∞	61 04	90 00	60 33	90 00
m	(110)	∞	60 53	90 00	60 33	90 00
p	(101)	10	89 55	36 10	90 00	36 14
p	(101)	10	90 03	36 10	90 00	36 14
s	(111)	1	60 26	40 06	60 33	40 05
s	(111)	1	60 15	40 18	60 33	40 05
s	(111)	1	60 33	40 14	60 33	40 05
s	(111)	1	60 40	40 01	60 33	40 05

In an endeavor to obtain further crystallographic data on the Arkansas wavellite a number of specimens of this material were examined. The best specimen from this locality in the Museum collections (Cat. 45866) consists of spherulitic aggregates of divergent crystals, which are transparent and of a beautiful sea-green color. Although in the body of the spherical group the crystals are deformed by crowding, their terminations diverge sufficiently to permit idiomorphic development. Several trials, however, showed that these are totally unsuited for goniometric measurement, the prismatic planes being exceedingly wavy, while the broad faces of the dome *p*(101) and the narrow faces of the basal pinacoid *c*(001), while transparent, are etched to complete dullness and give only the faintest reflection and no signal whatever. Only qualitative measurements were obtained, and these indicate the forms present to be *b*(010), *m*(110), *p*(101), and *c*(001). The aspect is chisel-shaped, as shown in the drawing, Figure 10.

A SPECIES OF ROUND WORM (GONGYLONEMA) FROM DOMESTIC SWINE IN THE UNITED STATES.

By Edward A. Chapin,

Of the Bureau of Animal Industry, United States Department of Agriculture.

In an examination of specimens of *Gongylonema* from American swine it was noted that there is a pronounced discrepancy between the spicule lengths of the species, which is common in swine in the United States, and the reported measurements of the same organs of *Gongylonema pulchrum* Molin, an European form supposed to occur in the New World. An examination of the available material showed that, as yet, the true *G. pulchrum* Molin is not represented among specimens collected in this country and deposited in the United States National Museum.

GONGYLONEMA RANSOMI Chapin.

Gongylonema ransomi Chapin, Journ. Amer. Vet. Asso., vol. 61, 1922, no. 1, p. 68, (Apr.)

Gongylonema.—Cuticle transversely striated; cuticular tubercles present in the anterior 1.0–1.3 mm. (female) or 0.6–0.9 mm. (male) of the body length (fig. 1), round, oval to nearly rectangular, arranged more or less regularly in rows. On the dorsal surface, between the lateral alae, there are four rows of tubercles, more or less evenly spaced one from another but somewhat concentrated near the dorsal line. Ventrally there are four complete rows of tubercles crowded toward the median line, with an incomplete row on either side, which is located between the external of the four rows and the lateral ala. Dorsal ala absent. Lateral alae short, extending a short distance beyond the posterior limit of the tubercles, slightly unequal in length. Cervical papillae situated on a craterlike depression upon a circular tubercle

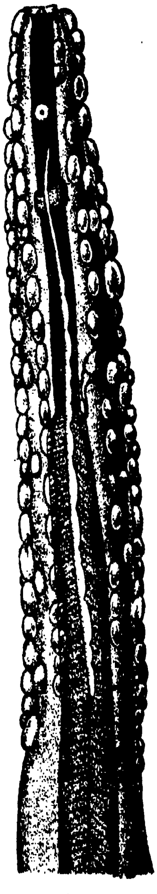

Fig. 1.—Gongylonema ransomi. Anterior extremity of female (enlarged).

located just cephalad of the cephalic end of the lateral ala. Excretory pore opens *between* tubercles of the median ventral rows, or on a transverse scute as in other species, just cephalad of the junction of the nonmuscular and muscular portions of the esophagus. Nonmuscular portion of the esophagus short, about 0.5 mm. in female, 0.4 mm. in male. Muscular portion long, in female about 4.5 mm., much shorter (2.85 mm.) in male.

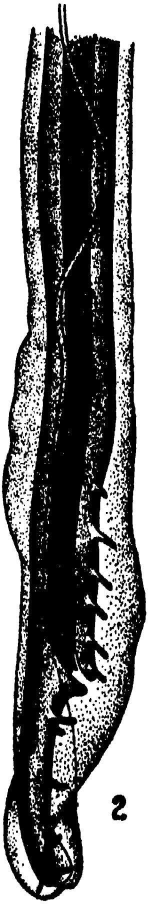

FIG. 2.—GONGYLONEMA RANSOMI. CAUDAL EXTREMITY OF MALE.

Male.—The caudal alae enclose the tip of the tail and are asymmetrical (fig. 2), the right wing being somewhat longer than the left. There are usually six preanal and four postanal papillae on each side, though the number varies. The anus is about 0.250 mm. from the tip of the tail. The caudal glands are subterminal. The right spicule (fig. 3) is short and stout, slightly curved and twisted, and measures 0.120 mm. between extremities in a straight line. The left spicule is very long, much thinner. It is about 10 mm. long. At its cephalic end it is infundibuliform, obliquely and irregularly emarginate. The "gorgeret" consists of two portions, a straight part, lying parallel to the short spicule and about 0.055 mm. long, and an oval part, lying dorsal of the spicules and directly back of the genital opening, about 0.029 mm. in diameter, giving a total length of 0.084 mm. for the organ.

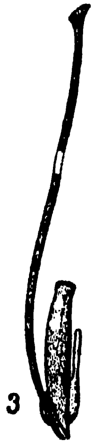

FIG. 3.—GONGYLONEMA RANSOMI. SPICULES AND GORGERET OF MALE (ENLARGED).

Female.—The tail is rather blunt and slightly curved, with subterminal caudal glands. The anus is about 0.200 mm. from the tip of the tail. The vulva is slightly salient, 1.75 mm. from tip of tail. The vagina is long, extending cephalad from the vulva to about the middle of the body length. The uteri are divergent and extend nearly to the extremities of the worm, merging into the oviducts and ovaries at these points. Eggs ovoid, embryonated in vagina, averaging 55.5μ long by 32μ wide.

Table of measurements.

Organ.[1]	Male.	Female.
Esophagus:		
Nonmuscular	400	500
Muscular	2,850	4,500
Cervical papillae	122	145, 154
Posterior limit of tubercles	580–900	1,010–1,300
Long (left) spicule	10,030	....
Short (right) spicule	106–130	....
Gorgeret	84	....
Vulva to tail	....	1,750
Anus to tail	250	200
Eggs	....	53–58 x 31–33
Total length (average)	23,000	37,000
Width at junction of esophagus and intestine	149.4	190.9

[1] All measurements in microns.

Location.—In burrows in the mucosa of the tongue and esophagus.

Locality.—United States: (East St. Louis, Illinois, National Stock Yards), collected by Dr. J. S. Jenison, May 7, 1921.

Host.—*Sus scrofa domestica.*

Type.—U.S.N.M. Helminthological Collections No. 24695.

The present species is easily separated from all known species of the genus except *G. verrucosum* Giles by the length of the left spicule; from *G. verrucosum* it is distinguished by the absence of a dorsal ala.

I have taken pleasure in dedicating this species to Dr. B. H. Ransom in recognition of his work on the nematodes of domestic animals.

THE NEOTROPICAL MUSCOID GENUS MESEMBRINELLA GIGLIO-TOS AND OTHER TESTACEOUS MUSCOID FLIES.

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The appearance of Dr. J. M. R. Surcouf's large Revision des Muscidae Testaceae (1919) suggested a study of the American forms included therein, in the course of which additional information came to light regarding the Australian genus *Palpostoma*, included but not seen by Surcouf. Following a brief sketch of the Muscidae Testaceae as a taxonomic concept, and a synopsis of the genus *Palpostoma*, with three species, the present paper confines itself to a consideration of the American representatives, in the genera *Ormia*, *Chloroprocta*, *Hemilucilia*, and *Mesembrinella;* these are all exclusively neotropical.

The material herein described is all in the United States National Museum except as noted. Through the kindness of Maj. E. E. Austen some important specimens, including two new species, were borrowed from the British Museum. Professor Bezzi, of Turin, Italy, also sent for study several species from his collection, which had been determined by Doctor Surcouf. The important tropical collection of the American Museum of Natural History contained several species, which were placed at my disposal; Prof. O. A. Johannsen furnished representatives of eight species; Prof. James S. Hine sent specimens of *Mesembrinella bicolor* that he had himself collected in British Guiana; two new species were received from the Bavarian State collection through Dr. E. O. Engel; and Dr. W. M. Mann brought several specimens which he collected in Bolivia while a member of the Mulford Biological Exploration. Prior to these acquisitions and loans, the National Museum had purchased a considerable series from Pablo Schild, in Higuito, Costa Rica. In the interesting and important Australian genus *Palpostoma* the material was furnished by Dr. J. F. Illingworth and Dr. Gerald F. Hill.

Robineau-Desvoidy proposed the term Muscidae Testaceae (1830, p. 425) for four genera of muscoids which agreed in having nonmetallic testaceous or yellow color—*Bengalia*, *Phumosia*, *Ormia*, and *Palpostoma*. Macquart (1835, p. 248) lumped all these as subgenera under a new genus *Ochromyia;* later (1843, p. 276) he recognized *Bengalia* as a distinct genus. Brauer and Bergenstamm, in their final synopsis of the muscoid flies (1893, p. 178) tabulate *Ochromyia* and *Bengalia* together, omit *Ormia* and *Palpostoma* as unknown to them, and add two new genera, *Zonochroa* and *Auchmeromyia*. Brauer alone later (1895, p. 594) takes up the group again, adding the neotropical *Mesembrinella* Giglio-Tos and one new, *Hemilucilia*, from South America.

Including all the above genera and several more recent from the Old World, adding *Chloroprocta* Van der Wulp from tropical America and six new genera from the Eastern Hemisphere, Surcouf has constructed a modernized Muscidae Testaceae of 20 genera, 2 subgenera, and some 29 species. He includes without having seen them *Ormia* and *Palpostoma*, which, although included in 1830, are totally divergent forms, as shown by the material of both in the United States National Museum. Omitting these from the group, it still remains a question whether the remainder form a natural tribe. *Bengalia* would be the typical form around which the rest should be grouped if sufficiently related; and characters other than color would have to be found to unite them.

Villeneuve (1920, p. 225), criticizing Surcouf's grouping because the genera assembled are not sufficiently related to each other, tabulates the Calliphorinae *sens. lat.* and limits the Testaceae to Xanthocalliphorinae Villeneuve, new name—in which, however, he does not include either *Bengalia* or *Phumosia*, the foundation of Robineau's group. No American known genus would be included in Xanthocalliphorinae, even after adopting some changes suggested by Surcouf in an answer to the criticism.[1] Nor do I believe that any American genus can be associated with *Bengalia* or *Phumosia* in a natural group of smaller dimensions than Calliphorinae in the wide sense.

Without giving the other Old World genera further consideration here, I take up *Palpostoma* and pass to the neotropical forms.

Genus PALPOSTOMA Robineau-Desvoidy.

Palpostoma Robineau-Desvoidy, Myodaires, 1830, p. 429.
Opsophasiops Townsend, Proc. Biol. Soc. Wash., vol. 28, 1915, p. 22; Insecutor Ins. Menst., vol. 3, 1915, p. 115, syn.
Palpostoma Surcouf, Revision Musc. Test., 1919, p. 116, not seen.

The type and sole original species of *Palpostoma* is *testacea*, from Australia. The characters for both genus and species were given in a few words—arista barely pubescent; proboscis at tip with a pair of distinct, jointed palpi; apical cell petiolate; color wholly pale testaceous; transverse facial impression yellow; 3 lines long. The genus was not recognized from 1830 to 1915, as far as I know; in the latter year Townsend[1] identified it from Tasmania, a species which he regarded as *testacea* having been described by Coquillett (1900, p. 390) as *Myiophasia flava.* The 2 males described by Coquillett are in the United States National Museum, and 11 additional specimens of the genus have been received from Dr. J. F. Illingworth, all collected or reared at Cairns, North Queeensland. The supposed labellar palpi are little soft posterior prolongations, which in drying assume various shapes, sometimes quite like palpi; they are not jointed, in spite of Robineau's assertion.

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[1] Bull. Soc. Ent. France, 1920, p. 250.

The generic characters are as follows:

Front very narrow in the male, in the female of *testacea* also very narrow, of *desvoidyi* 0.27 the head width. When the front is narrow there are no developed verticals, nor orbitals, but the female of *desvoidyi* has the usual two pairs of each, the latter small; ocellars very small, directed forward; frontals small, beginning well before ocellar triangle and reaching only to lunula; front not prominent; antennae ordinary, third joint about 2½ times the second and reaching nearly to the vibrissae, which are somewhat above the mouth and a little approximated; facial ridges low and bare, a few short stubby hairs about the vibrissae; transverse impression large, extending below the eye to form most of the bucca, which is from one-fourth to one-third the eye height in profile; parafrontal and parafacial narrow, with short but distinct hairs arranged somewhat in two or three rows, extending to the lower edge of the eye; back of head not bulging; proboscis small, palpi normal, labella as above noted. Thoracic chaetotaxy: acrostichal, anterior 1, posterior 1; dorsocentral, anterior 2–3, posterior 3; humeral 2; posthumeral 1; presutural 1; notopleural 2; supraalar 1; intraalar 1 (far back); postalar 2; scutellar, 1 apical, 1 lateral; prothoracic 1; mesopleural, 1 above, 1 anterior, 4 posterior; sternopleural, 1–2 anterior, 1 posterior; pteropleural, 1 small; hypopleural, row of 8 slender. All the specimens show a well-developed pair of prosternal bristles, a very unusual character.

Abdomen with dorsum curved downward apically on account of the shortness of the sternites; female without any apical piercing structures, showing seven sternites all of nearly equal length except the second which is longer; male with small genitalia; no discal bristles on intermediate segments.

Legs of ordinary structure, claws and pulvilli long in male, short in female; middle tibia with a small bristle on inner front side.

[1] Ins., Ins. Menst., vol. 3, 1915, p. 115

Wing with petiolate apical cell, the petiole only a little before the apex of the wing; third costal segment very short, much shorter than fifth; first vein bare, third with a few hairs.

In regard to the real relationships of this genus, it will be noted that Coquillett put his species in *Myiophasia.* Townsend in detecting the characters of *Palpostoma* in the specimens did not remove them from the drawer containing *Myiophasia* in the wide sense, and never published any comment on the proper position of the genus. It probably should stand in a tribe by itself.

TABLE OF SPECIES.

Hind and apical cross veins parallel, or almost so................ **flava** Coquillett.
Hind cross vein much less oblique than apical.
  Sternopleura in front of middle coxae with a double row of bristles and some smaller hairs, male with three sternopleurals at upper margin. **testacea** Robineau-Desvoidy.
  Sternopleura in front of middle coxae bearing a single transverse row of bristles, male with only two sternopleurals at the upper margin.. **desvoidyi**, new species

PALPOSTOMA TESTACEA Robineau-Desvoidy.

Palpostoma testacea Robineau-Desvoidy, Myiodaires, 1830, p. 429.

A wholly yellow species with a trace of median brown pollinose stripe on the abdomen, which is also sprinkled with brown dots from which the hairs and bristles arise. The second abdominal segment has a weak row of marginals, the third a stronger row, the fourth a few weaker. Hind cross vein a little oblique and at its anterior end incurved, especially in the male. The front of the female is at the narrowest only two-thirds as wide as in the male.

Length, 6 mm.

Five males, one female, Cairns, North Queensland, Australia, J. F. Illingworth, collector; four reared from adults of the Scarabeid beetle *Lepidoderma albohirtum* Waterhouse. Three males are returned to Doctor Illingworth.

I decide on this as *testacea,* since it is exactly the size mentioned by Robineau, and comes from Australia—excluding *flava* from consideration as not from the continent of Australia.

PALPOSTOMA FLAVA Coquillett.

Myiophasia flava Coquillett, Proc. Linn. Soc. New South Wales, 1900, p. 390.
Opsophasiops flava Townsend, Proc. Biol. Soc. Wash., vol. 28, 1915, p. 22.
Palpostoma testacea Robineau-Desvoidy, Towsend, Insecutor Ins. Menst., 1915, p. 111.

The two males described by Coquillett have the front at narrowest only as wide as the anterior ocellus; the abdomen is spotted with brown as in the preceding, and has a median brown line. Length, 4.7 mm. "West Australia; bred from adults of the Scarabeid *Anoplostethus opalinus* Burm." Coquillett suggests that *Neophasia picta* Brauer and Bergenstamm may be congeneric, founded on a female without antennae from West Australia.[3] Their description, however, seems to show but little relationship.

Type and paratype.—Male, Cat. No. 10431. Both bear distinct printed labels, "Tasmania, Austr. Arthur M. Lee, collector." This disagrees with Coquillett's indicated locality.

PALPOSTOMA DESVOIDYI, new species.

Male.—Very similar to the two preceding, but differing by the characters given in the table; also by smaller size from *testacea* Second abdominal segment with a pair of median marginals, a space between them and the other marginals.

Female.—Front 0.27 of head width above, slightly broader at antennae.

Length of male, 4.4 mm. to 5 mm.; of female, 6 mm.

Three males, two females, Cairns, North Queensland, Australia, J. F. Illingworth, collector. Two are reared from *Lepidiota frenchii* Blackburn, a scarabeid beetle injurious to sugar cane.

Type and allotype.—Male and female, Cat. No. 25242, U.S.N.M. One paratype of each sex is returned to Doctor Illingworth.

Genus ORMIA Robineau-Desvoidy.

Ormia ROBINEAU-DESVOIDY, Myodaires, 1830, p. 428.
Phasiopteryx BRAUER and BERGENSTAMM, Zweifl. Kais. Mus., pt. 4, 1889, p. 146.
Neoptera VAN DER WULP, Biologia, Dipt., vol. 2, 1890, p. 165.
Euphasiopteryx TOWNSEND, Proc. Biol. Soc. Wash., vol. 28, 1915, p. 23.
Ormiophasia TOWNSEND, Insecutor Ins. Menst., vol. 6, 1918, p. 164.

ORMIA PUNCTATA Robineau-Desvoidy.

Ormia punctata ROBINEAU-DESVOIDY, Myodaires, 1830, p. 428.—TOWNSEND, Ent. News, vol. 26, 1915, p. 366.
Phasiopteryx bilimeki BRAUER and BERGENSTAMM, Zweifl. Kais. Mus., pt. 4, 1889 p. 147; pt. 6, 1893, p. 159.
Neoptera rufa VAN DER WULP, Biologia, Dipt., vol. 2, 1890, p. 165.
Clytiomyia punctata, new species, COQUILLETT, Journ. N. Y. Ent. Soc., vol. 3. 1895, p. 52.
Oestrophasia punctata COQUILLETT, Coquillett, Revision N. Amer. Tachin., 1897, p. 71.

This species, type of *Ormia*, was not seen by Surcouf. It is well represented in the United States National Museum collection from

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[3] Denkschr. Kais. Mus., 1893, p. 210.

Florida and Mexico. It is wholly unlike *Bengalia*, being a small Tachinid with bare arista; it is honey yellow in color, the epaulet at base of costa strikingly black and the small cross vein clouded; the prosternum is greatly swollen in both sexes, as in the Indian *Therobia abdominalis*, which is related. The male has an enormous thickening of the costa beyond the middle, and another in the second vein just behind it. There are probably two or three other species of *Ormia* in America, not at present well known.

Genus HEMILUCILIA Brauer.

Hemilucilia Brauer, Sitzungsber. Kais. Akad. Wien, vol. 104, 1895, p. 104.—Surcouf, Revis. Musc. Test., 1919, p. 54.

The type is *Musca segmentaria* Fabricius, the sole species included. It is much more closely related to *Chrysomyia* than to *Bengalia*, and is out of place in Surcouf's group. The face is vertical and the lower part of head strongly developed as in *Chrysomyia*, from which it differs chiefly in having the facial ridges very high and sharp, inclosing the antennae in a deep groove; the third antennal joint is very long, and the vibrissae are at the oral margin, only a little approximated to each other. The stem vein of the wing is ciliated behind, as in *Chrysomyia*, a character of decided generic value except apparently in *Mesembrinella*.[4] Both species have the wings infuscated except a paler area in the middle third which does not reach the hind margin. Both *Hemilucilia* and *Cochliomyia* Townsend (type *macellaria* Fabricius) differ from *Chrysomyia* in having the lower calypter bare above except at base, it being hairy to the edge in *marginalis* Wiedemann, the type of *Chrysomyia*.

TABLE OF SPECIES.

Humeri, postalar callosities and anterior part of mesopleura yellow; legs yellow; both thoracic spiracles pale yellow .... **segmentaria** Fabricius.
Humeri, etc., green or blue; legs mostly black; in female the front narrowing near the antennae; the metathoracic spiracle blackish....... **fuscanipennis** Macquart.

HEMILUCILIA SEGMENTARIA Fabricius.

Musca segmentaria Fabricius, Syst. Antl., 1805, p. 292.—Wiedemann, Auss. Zweifl. Ins., vol. 2, 1830, p. 401.

Chrysomyia hyacinthia Robineau-Desvoidy, Myiodaires, 1830, p. 450.

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[4] This character, first mentioned by Pandellé (Revue Ent., 1896, p. 213), afterwards by Villeneuve (Bull. Soc. Ent. France, 1913, p. 163, etc.), and later on by Rodhain and Bequaert (Bull. Sci. France et Belg., ser. 7, vol. 49, 1916, p. 244) is a very important one. The cilia are found on the large vein at the base of the wing behind the costa and basad of the humeral cross vein. I have found them in the following out of many genera examined: *Phormia* in the wide sense; *Chrysomyia* in the wide sense; all *Rhiniinae* of Townsend's 1917 Revision except *Pollenia*, which probably does not belong to the tribe; *Nitellia vespillo* Fabricius; *Sarconesia chloropyga* Wiedemann; *Phrissopodia splendens* Macquart; *Sarconesiopsis caerulea* Townsend; *Chlorobrachycoma splendida* Townsend; *Hemilucilia* and *Chloroprocta*. They never occur in *Lucilia* and *Calliphora*.

Lucilia segmentaria BRAUER and BERGENSTAMM, Zweifl. Kais. Mus., pt. 5, 1891, p. 420 (in list).

Hemilucilia segmentaria BRAUER, Sitzungsber. Kais. Akad. Wien, vol. 104, 1895, p. 598.—SURCOUF, Revis. Musc. Test., 1919, p. 55.

All the published references are to material from South America. The species is represented in the United States National Museum by a male and four females, from Costa Rica, Panama, Peru, and Paraguay. Surcouf quotes the previous descriptions and gives a new one in detail from the type. The species is easily recognized by the characters already mentioned. The front in the male is black only at the vertex and much narrower outside the frontal bristles than in *macellaria*.

HEMILUCILIA FUSCANIPENNIS Macquart.

Lucilia fuscanipennis MACQUART, Dipt. Exotiques, Suppl., vol. 4, pt. 2, 1851, p. 223.

Described from Bahia, Brazil; the United States National Museum has a male and four females, from Panama and Costa Rica, identified as *Phormia fuscanipennis* by Coquillett, and placed in *Hemilucilia* by Townsend. It is a smaller and darker species than the preceding, the front black nearly to the antennae, where there is a sharp change to yellow.

Genus CHLOROPROCTA Van der Wulp.

Chloroprocta VAN DER WULP, Biol. Cent. Amer. Dipt., vol. 2, 1896, p. 296.

Nearly allied to *Cochliomyia* Townsend, with which it has in common the ciliation of the stem vein of the wing; vibrissae a little above the edge of the mouth and somewhat approximated to each other; acrostichal and dorsocentral bristles except the hindmost very small and hardly discernable; lower part of head strongly developed; face straight and almost vertical; frontals extending slightly below insertion of antennae; hind calypter bare beyond the fold. It differs in having the head much flatter (shorter on the longitudinal axis of the insect), more concave behind, the upper edge thin, especially in the male; the female has the parafrontals outside the frontal bristles much narrower; the male has the eyes contiguous for some distance, the upper front portion with very large facets as in males of *Tabanus*, as large as the posterior ocelli but not quite equalling the front one. The genus would certainly have to be placed in the same tribe with *Chrysomyia* and *Cochliomyia*.

CHLOROPROCTA SEMIVIRDIS Van der Wulp.

Chloroprocta semivirdis VAN DER WULP, Biol. Cent. Amer. Dipt., vol. 2, 1896, p. 296.

Two males and a female in the United States National Museum collection, from Costa Rica, Brownsville, Texas, and Colima, Mexico, determined by Townsend, show but little trace of the testaceous color of the thorax mentioned so prominently by Van der Wulp; the base of the abdomen is yellow, however, and there are indications of red in the pleurae in all the specimens, the mesonotum nevertheless would have to be called blue green. Legs brownish red. Wings wholly infuscated, but darker apically near the costa.

MESEMBRINELLA Giglio-Tos.

Mesembrinella Giglio-Tos, Boll. Mus. Zool. ed. Anat. Comp. R. Univ., Torino, vol. 7, No. 132, p. 4 (Oct. 1892); Mem. R. Acad. Sci., Torino, ser. 2, vol. 45, 1895 (Ditt. del Mess., pt. 4), p. 11. Type, *Musca quadrilineata* Fabricius, by designation, 1892.

Mesembrinella Brauer, Sitzber. Kais. Akad. Wiss., vol. 104, 1895, p. 594.

Huascaromusca Townsend, Insecutor Ins. Menst., vol. 6, 1918, p. 155 (type *cruciata*, new, from Peru).

Ochromyia and *Mesembrinella* Surcouf, Revis. Musc. Testaceae, 1919, p. 63.

We still have to consider as American representatives of Surcouf's group his *Ochromyia* and *Mesembrinella*. His use of both names is open to question. The type of *Ochromyia* was distinctly designated at its first publication as *Musca jejuna* Fabricius. This species from Surcouf's examination of the type is a *Bengalia*, and in fact the only species known of this genus, of which all Desvoidy's names are probably synonymous (although Surcouf mentions only *testacea*, designating it as type of *Bengalia*,[5] omitting the others from consideration). Obviously *Ochromyia*, 1835, is a synonym of *Bengalia*, 1830, having the same genotype. Now *Mesembrinella* also has a genotype, designated when it was first published, which is *Musca quadrilineata* Fabricius. This species from the type Surcouf places in *Ochromyia*. This situation would seem to require the transfer of the name *Mesembrinella* from Surcouf's group of that name to his *Ochromyias*, left without a name by making *Ochromyia* a synonym of *Bengalia*. There is, however, an alternative which largely does away with the confusion which a transfer would entail, namely, the union of both genera as taken by Surcouf under the name *Mesembrinella*. A consideration of the generic characters used by Surcouf shows that this is not only practicable but unavoidable. He separated the genera on the presence of one anterior sternopleural in *Ochromyia* and two in *Mesembrinella*, both groups having also one posterior. The commonest Central American species varies frequently between one and two anterior sternopleurals, the lower when present sometimes very small, hardly more than a hair. Other characters seem to be merely specific.

The combination gives a natural genus having several species in the neotropical region.

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[5] Townsend, Ins. Ins. Menst., vol. 4, 1916, p. 6, had already designated *Bengalia labiata* as type, but this is no doubt the same species.

Generic characters: hypopleural bristles present, arista plumose to tip, eyes bare, bend of fourth vein obtuse and broadly rounded, thence straight and ending only a little before the apex of wing (if there is any concavity at all it is just at the tip, not immediately after the bend); first posterior cell wide and broadly open, sometimes very broadly; frontal bristles not continuing below insertion of antennae; female with a pair of decussate bristles on the frontal stripe, below the ocelli; eyes bare; bucca narrow, about one-fifth to one-sixth eye height; first and second abdominal segments without median marginals; no discals except in two species on the fourth segment. They are easily separated from *Calliphora* by the course of the fourth vein, the much narrower bucca, the arista plumose to the tip, hind calypter bare above, and in the female decussate bristles on the front.

The two species herein identified as *Mesembrinella bicolor* Fabricius and *bellardiana*, new species, are fairly common in collections (I have examined approximately 50 of the former, 12 of the latter), but it is a very difficult matter to get enough of the others to determine the value of the characters. Both of the common species vary in the number of sternopleurals; posterior acrostichals may apparently vary from one to three pairs; a third humeral is usually present, but often small and sometimes merely hairlike; the foremost anterior dorsocentral also may be small, so there is no real difference worth mentioning between two and three in this series; supraalars seem to vary from two to four in the same species; there may be two lateral scutellars or only one. On the other hand, there seems to be more constancy in the color of the wings than would be expected; the second presutural is regularly present in some species, absent in others; while one or two pairs of anterior acrostichals as compared with none seems to be a stable character. Color of the legs, as in *brunnipes*, I view with misgiving, but have too little material to prove anything.

The presence or absence of the second presutural bristle separates two very natural groups, the former including the type species; the absence of this bristle is generally accompanied by the absence of the second posthumeral, but the latter is well developed in *cruciata* and almost as well in *facialis*. The second presutural when present is mesad of the large outer presutural, which is always present, and a little behind the middle of a line drawn from the outer one to the dorsocentral, which is just before the suture. The posthumeral, which, as stated, usually varies with this, occurs halfway between the outer presutural and the humeral swelling.

TABLE OF SPECIES.

A^1. Stem of venation bare (subgenus *Mesembrinella*).
  a^1. Two presutural bristles present.
    b^1. Legs almost black, but middle and hind femora yellow on apical half.
      c^1. Wing with heavy subcostal black stripe, not reaching the third vein, the posterior portion paler; 3 posterior acrostichals (Bolivia, Surinam). **brunnipes** Surcouf.
      c^2. Wing deep brown, the second fourth, except behind, yellow (Bolivia). **pictipennis**, new species.
    b^2. Femora and tibiae yellow.
      c^1. Apical cell very wide open, the costal section included more than half as long as the preceding one (Costa Rica, Ecuador)..**umbrosa**, new species.
      c^2. Apical cell less widely open, the included costal section less than half the preceding.
        d^1. Wing with only diffuse and not very strong infuscation (widespread neotropical).................................... **bicolor** Fabricius.
        d^2. Wing with heavy blackish subcostal stripe, beyond middle, before third vein (Brazil)............................ **batesi**, new species.
  a^2. Only one presutural present.
    b^1. Fourth abdominal segment with a discal row of bristles.
      c^1. Femora, pleurae, and whole abdomen black; second posthumeral large; 2 pairs anterior acrostichals (Peru)................. **cruciata** Townsend.
      c^2. Femora, pleurae, and base of abdomen yellow.
        d^1. One pair anterior acrostichals.
          e^1. Posthumeral 1 (Panama)...................... **tibialis**, new species.
          e^2. Posthumerals 2 (South America)........... **aeneiventris** Wiedemann.
        d^2. No anterior acrostichals (Brazil).............. **purpurata**, new species.
    b^2. Fourth abdominal segment without discals.
      c^1. Facial ridges high and sharp, with bristles to middle; middle and hind tibiae not at all infuscated; sternopleurals 2, 1 (Costa Rica). **facialis**, new species.
      c^2. Facial ridges lower and not bristly except near vibrissae.
        d^1. Segments 2-4 of abdomen with posterior third or fourth of purple color, sharply limited anteriorly.
          e^1. No anterior acrostichals, only one intraalar (the posterior) (Brazil). **pauciseta**, new species.
          e^2. One or two anterior acrostichals; two intraalars (Brazil). **cyaneicincta** Surcouf.
        d^2. Abdomen without purple bands.
          e^1. Third abdominal segment with only weak hairs along the hind margin above (South America).......................... **randa** Walker.
          e^2. Third abdominal segment with a marginal row of well-developed bristles.
            f^1. Middle and hind tibiae black, in male the middle ones elongated and with all the bristles very minute (*flavipennis* Macquart). **quadrilineata** Fabricius.
            f^2. Middle and hind tibiae not or hardly infuscated, the male with the usual bristles on middle tibiae....... **dorsimacula**, new species.
A^2. Stem of venation ciliated behind (subgenus *Mesembolia*, type *bellardiana*).
  a^1. Greatest width of apical cell exceeding the length of the hind cross vein.
    b^1. Apical cell moderately wide open in margin, the intercepted costal segment not more than half the preceding one; no acrostichals immediately behind the suture (Mexico to Paraguay)............. **bellardiana**, new species.
    b^2. Apical cell very wide open, the intercepted costal segment more than half the preceding (Brazil).......................... **fulvipes**, new species.
  a^2. Greatest width of apical cell less than hind cross vein (Brazil). **peregrina**, new species

MESEMBRINELLA BRUNNIPES Surcouf.

Mesembrinella brunnipes SURCOUF, Revis. Musc. Test., 1919, p. 78, female. Bolivia, Surinam.

One of the type specimens from Bolivia, sent me for study by Professor Bezzi, shows the following characters.

Female.—Head and thorax brownish, almost acorn colored, the scutellum the same. Cruciate bristles distinct. Antennae and palpi yellow, third antennal joint darkened from the arista on the outer side; facial ridges with numerous hairs above the vibrissae, but ascending only as far as the lowest third of the third antennal joint. Mesonotum with whitish pollinose stripes, which when viewed from behind extend to the scutellum. Thoracic chaetotaxy: dorsocentral 2, 3; acrostichal 2, 3; humeral 3; posthumeral 2; presutural 2; notopleural 2; supraalar 4 large and 1 or 2 small; intraalar 2; postalar 2; scutellum with 1 apical, 1 discal, laterals 1 large and 2 small; sternopleural 1, 1 on one side, 2, 1 on the other.

Abdomen yellow at extreme base; at the middle of the first segment it begins to be densely black haired, and at this point it becomes darker and takes on a purple reflection; this color and reflection increase apically, until the fourth segment is deep purple with no trace of yellow; tergites with no bristles except a few very weak on hind margin of second and third segments; sternites each with half a dozen of about the same size as those on the tergites. Legs dark brown, all the knees and apical half of middle and hind femora yellow; middle tibia with a stout flexor bristle beyond middle. Wings infuscated, most densely in a heavy subcostal stripe beginning just behind the tip of the first and not nearly reaching the third vein; anterior cross vein deeply infuscated and the same spot drawn out along the fourth vein, but not the third; fifth vein and hind cross vein also margined with brown. First posterior cell rather widely open before apex of wing.

Length, 11.5 mm.; of wing, 12.5 mm.

One female from Bolivia (Professor Johannsen) agrees with the type.

MESEMBRINELLA PICTIPENNIS, new species.

Male and female.—A brown species with deep blue or purplish abdomen greatly resembling *brunnipes* Surcouf, except in the following characters; there are three anterior dorsocentrals instead of two; one posterior acrostichal instead of three; three supraalar instead of four; the wing is much darker; apical cell broader and more widely open. The color of the wing, which is the same in both sexes, is considerably different from that of *brunnipes*.

In *pictipennis* the wing is wholly infuscated beyond the small cross vein, except a slight yellow mark beyond the tip of the first vein and another very small beyond the tip of the second vein. The broad apical cell is somewhat lighter in the middle, especially in the female; the base of the wing as far as the tip of the second basal cell and the bifurcation of the second and third veins is brown. From the point mentioned to the small cross vein, and narrowly inclosing the latter, there is a bright yellow area, widest at the costa and extending a little into the discal cell, which is otherwise brown; there is thus in effect a yellow band extending halfway across the wing, which is elsewhere brown. The effect is different from anything in the genus so far as I have seen. The third costal segment (between the auxiliary and the first vein) is a little longer than the second and more than twice the fifth; the fourth vein is straight beyond the very broad bend and the apical cell is open at the costa for a distance longer than the anterior cross vein, or about half the posterior one.

The second abdominal segment has no marginal bristles, but the third has a few small ones; the fourth has erect hairs and at the apex a few small bristles. The eyes in the male are almost contiguous on the front, being separated by only about half the width of the anterior ocellus. The middle and hind femora are dark brown for more than half the length and the front ones entirely, except a narrow space underneath at tip.

Length of male, 13 mm.; of female, 13.5 mm.

Described from a male and female, collected at "Yungas de la Paz, Bolivia, 1000 M". Types in the British Museum. The species is nearest to *umbrosa*, but seems distinct in its vivid wing coloration, darker legs, etc.

MESEMBRINELLA UMBROSA, new species.

Mesembrinella bicolor GIGLIO-TOS, Van der Wulp, Biol. Centr. Amer. Dipt., vol. 2, 1896, p. 301, pl. 7, fig. 18.

Male.—Head, thorax, and legs rather uniformly brown in color, darker than in most of the species; abdomen except at base with some metallic blue reflections on brown ground. Front at narrowest only as wide as the anterior ocellus; third antennal joint brown; palpi and proboscis dark yellow. Thorax indistinctly darker along the middle on the mesonotum, hardly showing the usual stripes of pale pollen. Chaetotaxy: acrostichal 2 or 3, 1; dorsocentral 2, 3; humeral 3; posthumeral 3; presutural 2; notopleural 2; supraalar 3; intraalar 2; postalar 2, and a small; scutellum with 1 apical, 2 lateral both close to base, 1 discal close to edge; sternopleural 2, 1; a few pale hairs on hind calypter, on its attaching membrane above.

Abdomen brown, with blue reflections except at base; first and second segments without bristles even laterally, third and fourth with only a weak marginal row. Genital segments very small, brown; inner forceps parallel, slender, tapering, ending in a small up-curved hook; outer forceps slender and strongly bowed inward, their rounded tips approaching the tips of the inner pair. Fifth sternite with V-shaped incision, not with striking hairs or bristles. Legs uniform reddish yellow, the tarsi apically a little darker.

Wings strongly infuscated, first posterior cell a little paler in the middle and very widely open at margin, the intercepted costal segment two-thirds as long as the posterior cross vein; second costal segment longer than the following; third vein remarkably straight from cross vein to tip.

Length, 13 mm.

One male, Tucurrique, Costa Rica (Schild and Burgdorf); one male, one female, lent by Professor Bezzi, labeled "Archidona, Ecuador, R. Haensch S." This pair was placed by Mr. Surcouf along with two other females with the same label, under the name "*Mesembrinella quadrilineata* G. T. nec Fabricius." The pair, which I place provisionally under *umbrosa,* are larger than the others from the same place, and have the apical cell more widely open and the third vein bowed back toward the apex, besides having the stem of the venation bare. They differ from my Costa Rica type specimen, as far as I can make out in their poor condition, only in having a heavy subcostal infuscated stripe in the wing.

Two females from the British Museum; one of them from Cache, Costa Rica, was identified by Van der Wulp in Biologia as *bicolor* Giglio-Tos; the other is from Balzapamba, Ecuador, and is aberrant in having fulvous bristles and hairs, except the largest bristles, on the pleurae, coxae, femora, and tibiae. I can not decide whether this is a specific difference or not. One additional female, Bolivia (Johannsen).

Van der Wulp's figure of what he called *bicolor* Giglio-Tos shows a venation about as in *umbrosa* except that the first posterior cell is too much narrowed at the tip; Wulp also noted the long second segment of the costa in his text.

Type.—Male, Cat. No. 25246, U.S.N.M.

MESEMBRINELLA BICOLOR Fabricius.

Musca bicolor FABRICIUS, Systema Antl., 1805, p. 291.—WIEDEMANN, Auss. Zweifl. Ins., vol. 2, 1830, p. 392.

Calliphora socors WALKER, Trans. Ent. Soc. Lond., n. ser., vol. 5, 1860, p. 311.

Mesembrinella bicolor, new species, GIGLIO-TOS, Boll. R. Univ. Torino, vol. 8, No. 147, 1893, p. 4; Ditteri del Messico, vol. 4, p. 11 (Mem. R. Accad. Sci. Torino, ser. 2, vol. 45, 1895).

Mesembrinella aeneiventris VAN DER WULP, Biologia Cent. Amer., Dipt., vol. 2, 1896, p. 301, pl. 7, fig. 19.

Ochromyia bicolor FABRICIUS and *Mesembrinella bicolor* GIGLIO-TOS, Surcouf, Revis. Musc. Test., pp. 70, 76, pl. 3, fig. 6.

The type locality was "South America." Giglio-Tos and Van der Wulp described it from Oaxaca, Playa Vicente, and northern Yucatan, considerably farther north than any other of the genus. The synonymy of *socors* I make out from specimens sent me by Major Austen, which he compared with Walker's types.

Male.—Head, thorax, abdomen, and legs brownish yellow, the abdomen except at base blue green, and a slight tinge of the same on the mesonotum in certain lights. Thorax with four whitish pollinose stripes, more conspicuous in front; the intervening nonpollinose portions are, first, a median one between the acrostichals, and, second, one on each side beginning on the inner side of the humerus and the adjacent mesonotum, continuing mesad of the inner presutural and halfway between the intraalar and dorsocentral rows; there is also a very narrow pollinose line along the anterior dorsocentrals. Front at narrowest three-fourths as wide as ocellar triangle; antennae, palpi, and proboscis yellow. Chaetotaxy: acrostichal 2, 3; dorsocentral 2, 3; humeral 3; posthumeral 3; presutural 2; notopleural 2; supraalar 3; intraalar 2; postalar 2; scutellar 1 apical, 2 marginal, and 1 discal; sternopleural usually 2, 1, sometimes 1,1. A few pale slender hairs on attaching margin of hind calypter above, and usually some dark hairs on the middle of the vertical surface above it (behind postalar callus). Wing tinged with brown throughout, costa hardly darker, anterior cross vein infuscated.

Female.—Front about one-fifth head width, the stripe above equal to four times one orbit; orbitals small and variable, the upper often minute or absent. The acrostichals just behind the suture sometimes absent, and when this is the case the next posterior pair are sometimes absent also, or only one present. The paler specimens show the stripes most distinctly, and in these the wings have little infuscation except along the veins.

Length, 7.6 to 10.5 mm.

Two males from Bartica, British Guiana, determined by Surcouf as *Ochromyia bicolor* Fabricius; two males, two females, northern Yucatan (Gaumer), from the British Museum, determined as *aeneiventris* Wiedemann by Van der Wulp in his Biologia paper; one male from Costa Rica, determined by Surcouf as *Mesembrinella bicolor* Giglio-Tos (all the preceding from Professor Bezzi, and mentioned by Surcouf in his paper).

Fourteen males and nineteen females, Higuito, Costa Rica (Pablo Schild); one female, Piedra Negra, Costa Rica (Schild); two males, Tehuantepec, Mexico (Sumichrast); two females, Porto Bello, Panama (August Busck); one male, two females, Huachi, Bolivia (Wm. M. Mann); one male, two females, Bernardinos, Paraguay (K. Fiebrig); two females, Surinam and Venezuela (Professor Johannsen); one male, one female, Bartica, British Guiana (J. S. Hine). The last pair in my own collection; all the rest in the United States National Museum.

Inasmuch as Mr. Surcouf divided his material generically on the number of sternopleurals, he naturally placed the material that he saw in two genera, and hence failed to perceive the identity of the two species named *bicolor*. This is by far the commonest species of the genus, and has a wide range.

MESEMBRINELLA BATESI, new species.

Female.—A brown species with only slight metallic tinge on the abdomen, the pale abdominal pollen arranged in small, short, transverse "ripple marks."

Head light yellow, darker at vertex, the entire orbit with white pollen; front rather wide for the genus. Thorax acorn colored above, more yellow on sides. Chaetotaxy: acrostichal 2, 1; dorsocentral 2, 3; humeral 3; interhumeral 1; posthumeral 2; presutural 2; supraalar 4; intraalar 2; postalar 2; scutellar 1 apical, 1 and a small lateral, 1 discal; sternopleural 1, 1.

Abdomen with less metallic reflection than any other species except *facialis*, while the ripple marks above mentioned are not found in any other species that I have seen; they seem to originate from small pollinose dots at the base of the hairs, which coalesce in minute and short transverse rows; they occur even upon the small fifth segment. Third segment with very weak and depressed marginal bristles, those of fourth little stronger. Legs yellow, middle and hind tibiae with a trace of infuscation. Wings hardly infuscated except for the heavy subcostal dark stripe; apical cell not very wide for the genus, its costal opening less than half as long as the preceding costal segment.

Length, 12 mm.

One female, Amazon River, 65.53, collected by H. W. Bates.

Type in the British Museum.

MESEMBRINELLA CRUCIATA Townsend.

Huascaromusca cruciata TOWNSEND, Insecutor Ins. Menst., vol. 6, 1918, p. 155.

Female (type).—Black except antennae, palpi, and front of head, which are yellow. Front narrow for a female, about 0.22 of the head width, at vertex, not much wider at antennae, moderately wider below; head black above to about middle of front, thence yellow to lower curve of eye or more, gradually changing color in both regions; ocellars, orbitals, and frontals large; the next bristle above the usual two orbitals is in the frontal series, turned laterally, above this the strong, reclinate vertical (not as given by Townsend, with three orbitals); a pair of cruciate bristles in the frontal stripe below the ocelli; third antennal joint more than twice the second.

Thorax dull black with slight cinereous pruinosity, more pollinose at extreme front edge; bristles long and erect. Chaetotaxy: dorsocentral 2, 3; acrostichal 2, 1; humeral 3; posthumeral 2; presutural 1; notopleural 2; supraalar 3; intraalar 2; postalar 3; scutellar

1 apical, 2 lateral (1 small), 1 discal (far apart); sternopleural 2, 1. Calypters brown, with blackish margin.

Abdomen wholly black, the second and third segments with violet reflections; second segment with only one or two appressed marginals at side; third with erect row of 12 slender marginals; fourth with row of 12 discals not so large, and as many marginals still smaller.

Legs black, still a little indication of yellow underneath on apical fourth of all the femora; tibiae with rather long bristles.

Wings with slight brown tinge, anterior cross vein infuscated; fourth vein curved backward before the bend, so the first posterior cell is very wide in this part; it ends a little before the apex, widely open.

Length, 8.8 mm.

Type.—Female, Cat. No. 22054, U.S.N.M.

See note on *Somomyia xanthorrhina* Bigot at end of paper.

MESEMBRINELLA TIBIALIS, new species.

Male.—Head and its members yellow, the back, however, black except below inside the metacephalic suture; eyes nearly contiguous, separated by only the width of the front ocellus; parafacial very narrow, half as wide as the third antennal joint when viewed from in front; bucca one-tenth of head height; third antennal joint slender, two and a half times as long as the second.

Thorax brownish yellow on pleurae, humeri, and edges of dorsum; all its bristles stout. Chaetotaxy: dorsocentral 2, 3 (in all cases I mention the anterior before the posterior of the bristles); acrostichal 1, 1; humeral 2; posthumeral 1; presutural 1; supraalar 3; intraalar 2; postalar 2; sternopleural 1, 1; scutellum with 1 apical, 2 lateral, 1 discal (each side). Calypters rather brownish.

Abdomen narrowly yellow at base above, below yellow nearly to apex; second and third tergites violet on apical third, but this is not sharply divided from the color preceding it as in some species; first and second with only a lateral bristle, third with a marginal row of eight stout and erect, fourth with a discal row of eight and a marginal of about the same, all strong; fifth tergite visible as a distinct crescent at the base of the genital segments, the latter not prominent.

Coxae and femora yellow, all tibiae blackish, the front ones less so, all femora infuscated at tip.

Wings uniformly brown in color, hind cross vein oblique; fourth vein with rounded curve, at the extreme tip slightly recurved.

Length, 8.7 mm.

One male, Porto Bello, Panama, March 18, 1911 (August Busck).

Type.—Male, Cat. No. 25247, U.S.N.M.

MESEMBRINELLA PURPURATA, new species.

Male.—Like *tibialis* in almost every respect but lacking the anterior acrostichals and having a heavy subcostal brown stripe in the wing, beginning at the tip of the auxiliary and filling the space in front of the second vein. The antennae are a little longer than in *tibialis*, reaching almost to the vibrissae; the bristles on the upper edge of the hind femur are longer and in a single row; the hind tibia is a little flattened and has the calcar almost at two-thirds its length, while in *tibialis* it is nearer the middle.

Length, 10 mm.

One male, Espirito Santo, Brazil, collector unknown, from Prof. O. A. Johannsen.

Type.—Male, Cat. No. 25845, U.S.N.M.

MESEMBRINELLA AENEIVENTRIS Wiedemann.

Dexia aeneiventris WIEDEMANN, Auss. Zweifl. Ins., vol. 2, 1830, p. 376.

Ochromyia nigrifrons BIGOT, Annales Soc. Ent. France, 1878, p. 39.

Mesembrinella nigrifrons BRAUER, Sitzungsber. Kais. Akad. Wien, vol. 108, 1899, p. 518.

Mesembrinella aeneiventris SURCOUF, Revis. Musc. Test., 1919, p. 68, pl. 3, fig. 5.—VILLENEUVE, Bull. Soc. Ent. France, 1920, p. 224.

The type locality is "Brazil," and Bigot's material was also from there. Brauer merely refers Bigot's type to *Mesembrinella.*

A male specimen from Peru, identified by Surcouf and mentioned by him in his revision, has been kindly sent me for study by Professor Bezzi. It is so nearly like my *tibialis* that I at first thought them the same. Having only the two males, one of each, the question can not be settled positively; however, there are at least two pretty fair distinctive characters, as indicated in the table. *Aeneiventris* has a large posthumeral bristle halfway between the presutural and the hindmost humeral and in the same line with them, which is absent in *tibialis*. The other posthumeral, present in both, is equidistant from the presutural and the foremost of the anterior dorsocentrals, and considerably anterior to the line connecting them. The Peruvian specimen does not have the third posthumeral mentioned by Surcouf. There is a smallish but distinct flexor bristle beyond the middle of the middle tibia in *tibialis*, which is absent in *aeneiventris*. The genitals are on the same plan in the two specimens, but the inner forceps are larger in *aeneiventris* (in the proportion of 17 to 14), and the outer are slightly broader and more rounded apically. I can detect no other differences.

Surcouf did not see the type of *aeneiventris*, nor that of *nigrifrons*, which he places as a synonym.

RINELLA FACIALIS, new

Female.—Brownish yellow all over except the fourth abdominal segment and indistinct hind border of the third, running foward to a point in the median line, where the color is almost black, with no or almost no reflections. Front one-fifth head width, orbital bristles distinct; facial ridges distinctly high all the way up, with numerous short, black hairs up to the middle of the third antennal joint. Thorax with the usual pollinose stripes not very distinct. Chaetotaxy: acrostichal 2, 1 (the prescutellar as large as the adjacent dorsocentrals); dorsocentral 2, 3; humeral 2; posthumeral 2; presutural 1; notopleural 2; supraalar 3; intraalar 2; postalar 2; sternopleural 2, 1; scutellum with 1 apical, 2 lateral, 1 discal. The hind calypter along its attaching membrane bears black hairs, close to the thorax, none on its disk.

Abdomen short, globose, with almost no metallic reflections whatever; fourth segment covered with brown pollen; first segment without bristles, second with one lateral, third and fourth with a marginal row of a dozen, fifth also with a distinct row above. Sternites wide, each bearing a complete apical row of six and a broken subbasal of about four short, spiny bristles.

Wings rather uniformly infuscated, second costal segment two-thirds as long as the third.

Length, 9.2 mm.

One female, Higuito, Costa Rica (Pablo Schild).

Type.—Female, Cat. No. 25248, U.S.N.M.

MESEMBRINELLA PAUCISETA, new species.

Female.—Head and thorax, base of abdomen, coxae, femora, and front tibiae yellowish brown; dorsum of thorax rather dark brown; middle and hind tibiae infuscated, the former darkest, almost black. Antennae, palpi, and proboscis yellow. Abdomen with narrow violet posterior bands on segments 2 and 3, presumably also on 4, but it is soiled. Pollinose stripes distinct in front on thorax as in *bicolor*. Chaetotaxy: acrostichal 0, 1; dorsocentral 2, 3; humeral 2; posthumeral 1; presutural 1; notopleural 2; supraalar 3; intraalar 1; postalar 2; sternopleural 1, 1; scutellum with 1 apical, 1 lateral, 1 discal. Abdomen with a distinct median marginal pair and a lateral on the third segment, on the fourth a few smaller at tip.

Wings lightly infuscated, with a dark stripe between costa and third vein on apical half; first posterior cell intercepting a portion of the costa about equal to the anterior cross vein.

Length, 10 mm.

One female, near Para, Brazil (Miss H. B. Merrill).

Type.—Female, Cat. No. 25249, U.S.N.M.

MESEMBRINELLA CYANEICINCTA Surcouf.

Ochromyia cyaneicincta SURCOUF, Revis. Musc. Testaceae, 1919, p. 69, female.

This species, which I have not seen, is said by Surcouf to be almost like *aeneiventris* Wiedemann, differing, however, in having no abdominal bristles except a weak row on the tip of the fourth segment, while *aeneiventris* has marginals of larger size on both the third and fourth segments and discals on the fourth. Surcouf had only a single female from Brazil.

Length, 12 mm.; above the average size.

The type was from Brazil.

MESEMBRINELLA QUADRILINEATA Fabricius.

Musca quadrilineata FABRICIUS, Systema Antl., 1805, p. 286.

Mesembrina quadrilineata WIEDEMANN, Auss. Zweifl., vol. 2, 1830, p. 347.

Ochromyia flavipennis MACQUART, Dipt. Exot., vol. 2, pt. 3, 1843, p. 291, pl. 17, fig. 3.—SURCOUF, Revis. Musc. Test., 1919, p. 65, pl. 3, fig. 4.—VILLENEUVE, Bull. Soc. Ent. France, 1920, p. 224.

I have seen no material identified by Doctor Surcouf as *flavipennis*, but specimens agreeing well with his description have been received. I follow suggestions received from Maj. E. E. Austen, of the British Museum, in selecting this as the true *quadrilineata*, in spite of the supposed type examined by Surcouf. It is apparent from the original description and that of Wiedemann that the type of *quadrilineata* had a dark subcostal stripe, while the specimen received by Surcouf had no such mark. This would seem to oblige us to choose for the true *quadrilineata* between *randa* and *flavipennis*; the additional character mentioned by Fabricius, "Abdomen violaceum, nitidum" applies much better to the latter than the former. Doctor Villeneuve states that the type of *flavipennis* has no calcar on the hind tibia, but if I interpret this correctly the bristle is merely smaller and higher up than usual, at or above the middle.

Male.—Front fully twice as wide as the ocellar triangle, the median stripe very narrow above, the parafrontals light golden yellow, nearly as wide as the parafacials. Chaetotaxy: humeral 2; posthumeral 1 (anterior); acrostichal 0, 1; dorsocentral 2, 3; presutural 1; notopleural 2; supraalar 3; intraalar 2; postalar 2; sternopleural 2; scutellar 1 lateral, 1 apical, and a small discal; first abdominal segment with several at the side; second with only one; third with a widely spaced row of stout marginals; fourth with small marginals. General color yellow, the mesonotum behind and the scutellum nearly black; abdomen with about the apical third bluish violet; mesonotum with four distinct pollinose stripes, reaching the scutellum. Legs yellow, the middle and hind tibiae brown, slightly flattened, with only small bristles; these and their femora elongated, the latter slender. Wings longer and narrower than usual, yellowish brown in color, with heavy black subcostal stripe beginning beyond the auxiliary.

Female.—Front two thirds as wide as one eye, blackish above; most of the abdomen bright purple, highly polished; femora less elongated, the middle ones stouter.

Length, 11 to 11.5 mm.

Redescribed from one male and one female, Cauri Valley, Venezuela (Boston Society of Natural History, correctly identified by C. W. Johnson); one female, Kiaeteur, British Guiana (American Museum); and a pair from British Guiana (British Museum).

MESEMBRINELLA RANDA Walker.

Dexia randa WALKER, List Dipt. Ins., vol 4, 1849, p. 852.

Ochromyia quadrilineata FABRICIUS of Surcouf, Revis. Musc. Test., p. 66, text fig. 5, and pl. 3, fig. 2.

Male and female.—Greatly resembling *quadrilineata,* but less brightly colored. The front of the male is the same, and also the pollinose thoracic stripes; the abdomen, however, is slightly pruinose and bluish, not polished purple, and the third segment lacks the stout marginal row. This last is the main structural difference, as the chaetotaxy is otherwise the same. The middle and hind tibiae are as in *quadrilineata,* their femora, however, hardly so slender and elongated.

Length, 10 to 11.5 mm.

One male and one female, Brazil (British Museum), compared with the type of *randa* by Major Austen.

Five additional females agree, but lack the subcostal blackish stripe in the wing, thus corresponding with the supposed type of *quadrilineata* which was redescribed by Surcouf. I can hardly make this out a distinct specific character here, though it seems usually constant. One of these females was from French Guiana, sent me by Professor Bezzi, identified as *quadrilineata* by Surcouf and mentioned in his Revision; two are from Kiaeteur and one from Tukeit, in British Guiana (American Museum); the other from Surinam (Johannsen).

MESEMBRINELLA DORSIMACULA, new species.

Male.—A rather slender yellow species, with the blue color on the abdomen very distinct but reduced to much smaller area than usual. Wholly yellow except the scutellum and a large spot immediately before it, which are deep brown and somewhat metallic; and a blue area including the fourth abdominal segment, most of the third above, and a small median posterior spot on the second: middle and hind tibiae brown. Front at narrowest at least twice the width of the ocellar triangle. Chaetotaxy: acrostichal 0, 1; dorsocentral 2, 3; humeral 2; posthumeral 1; presutural 1; notopleural 2; supraalar 3; intraalar 2; postalar 2; sternopleural 1, 1; scutellum with 1 apical, 1 lateral, 1 discal.

First abdominal segment with a well-developed vertical row of five bristles at the side (laterals); second with only one; third with scattered marginal row of six ending abruptly at the side; fourth with only a few weak marginals. Genital segments small, brown, the fifth abdominal not visible at their base; fifth sternite small, yellow, with V-shaped incision, no apical bristles.

Femora rather slender; middle and hind tibiae brown, somewhat swollen, the latter especially are nearly as large as their femora.

Wings yellow, more brown apically, with a well-marked brown subcostal stripe beyond middle, which is as usual not sharply limited.

Length, 11 mm.

One male, Brazil, "Collection Coquillett," collector unknown.

Type.—Male, Cat. No. 25250, U.S.N.M.

MESEMBRINELLA (MESEMBOLIA) BELLARDIANA, new species.

Mesembrinella quadrilineata FABRICIUS, Giglio-Tos, Boll. R. Univ. Torino, vol. 8, No. 147, 1893, p. 4; Dittori del Messico, pt. 4, 1895, p. 12.—SURCOUF, Revis. Musc. Test., 1919, p. 75.

Mesembrinella quadrilineata GIGLIO-TOS, not Fabricius, Surcouf, Revis. Musc. Test., 1919, p. 75.

Inasmuch as Surcouf placed the Fabrician species in *Ochromyia*, he recognized the name of Giglio-Tos as valid for the present one, crediting Giglio-Tos with the authorship. In combining his genera I am obliged to find a new name for the latter species. Since Bellardi was the one who first identified the specimens, I commemorate his work on the Mexican Diptera in the name I choose.

Female.—This species is of general brownish-yellow color, the abdomen except the base metallic blue green. Front about 0.23 of head width, with two orbitals and one pair of cruciate bristles; facial ridges depressed in the middle, hairy from vibrissae up to lower third of antennal joint; palpi large and broad; proboscis small; bucca one-sixth the eye height. Thorax dark brown dorsally. Chaetotaxy: acrostichal 2, 1; doroscentral 2, 3; humeral 2; posthumeral 2; presutural 2; notopleural 2; supraalar 3; intraalar 2; postalar 2; sternopleural 2, 1; scutellum with 1 apical, 2 lateral (both close to base), 1 discal.

Abdomen metallic blackish green above from beyond middle of second segment, below only from middle of third segment. Third and fourth abdominal segments with weak marginal row of bristles.

Legs yellow; hind femora with dense row of hairs above to beyond middle and one bristle beyond at second third of length. Wings brownish, with a heavy blackish subcostal stripe beginning at tip of auxiliary; beyond tip of second vien is a small paler spot, and a very narrow one lies beyond the tip of the first vein. First posterior very wide open, the intercepted costal segment being half as long as the hind cross vein.

Length, 12 mm.

One female, Brazil, collector unknown; three females from Bavarian State collection, from Espirito Santo, Brazil; four females in Professor Bezzi's collection, two being from Archidona, Ecuador; one from Puerto Bertoni, Alto Parana, Paraguay; one from Santo Cathrina, Brazil. These four specimens were referred by Surcouf to *Mesembrinella quadrilineata* Giglio-Tos, on comparison with the Giglio-Tos type. One female, Huachi, Bolivia, collected by Dr. Wm. M. Mann. Two females, Espirito Santo, Brazil, from Professor Johannsen's collection.

Type.—Female, Cat. No. 25251, U.S.N.M., from Brazil.

MESEMBRINELLA (MESEMBOLIA) FULVIPES, new species.

Female.—Head yellow; thorax yellow, a little brownish dorsally; abdomen yellow, the second segment a little metallic above and the third and fourth wholly metallic blue green. All the hairs and smaller bristles are golden or fulvous yellow on the head, thorax except dorsum, base of abdomen on the sides and below, coxae, femora, and tibiae; even the hypopleural bristles have this color. Thoracic chaetotaxy: acrostichal, 3 anterior, 2 posterior; dorsocentral 3, 3; humeral 3; interhumeral 1; posthumeral 2; presutural 2; notopleural 2; supraalar 5 on left, 3 and a small on right; intraalar 2; postalar 2; scutellar 1 apical, 1 lateral, 1 discal (far apart); sternopleural 3, 1 on right, 2, 1 on left. Third and fourth abdominal segments with a few rather stout marginal bristles above.

Legs entirely fulvous, only the apical part of tarsi darkened by black hairs. Wings but little infuscated except the heavy subcostal stripe; apical cell very broad, its opening in costa more than half the preceding costal section.

Length, 13 mm.

One female, Espirito Santo, Brazil, from the Bavarian State collection; and one male not very well preservered, from the same locality, in Professor Johannsen's shipment.

Type.—Female, Cat. No. 25252, U.S.N.M.

MESEMBRINELLA (MESEMBOLIA) PEREGRINA, ne

Male.—Eyes practically contiguous on the front, separated by less than the width of the anterior ocellus; head yellow except upper half behind, the antennae, palpi, and proboscis also yellow. Thorax brownish above with glaucous pruinosity, chaetotaxy as follows: acrostichal 2, 3; posthumeral 2; humeral 3; notopleural 2; intraalar 2; postalar 2; scutellum with 1 lateral near base, 1 discal, 1 apical; sternopleural 1, 1, and sometimes 1 lower very small. Abdomen mostly blue, shading gradually to yellow toward the base. Third segment with a row of 10 smallish marginals; fourth segment with erect hairs, among which are scattered a few more than twice as long, also erect, the marginals not larger than the latter. Legs wholly yellow, the tarsi darker toward the tips. Wings rather uniformly infuscated, still a little deeper clouding follows the main veins and the cross veins, especially the anterior cross vein. Apical cell with a narrow opening, hardly as long as anterior cross vein.

Length, 9.2 and 9.5 mm.

Two males, Espirito Santo, Brazil, from the Bavarian State Museum.

Type.—Male, Cat. No. 25887, U.S.N.M.

Three females, Espirito Santo, Brazil (Professor Johannsen), agree with the males. The front is rather narrow, about half the width of one eye.

OTHER SPECIES NEAR MESEMBRINELLA.

Calliphora xanthorhina BIGOT, Bull. Soc. Ent. France, 1887, p. 180; Bull. Soc. Zool. France, vol. 12, p. 602. (*Somomyia.*)

The type, from Mexico, was referred to *Mesembrinella* by Brauer.[6] The description gives legs black; wings pale grey with small cross-vein infuscated. These characters are different from anything included herein. The "*chrysorrhea* Mcq." referred to by Brauer in this connection is a MS. name by Moritz, not Macquart, on a specimen in the Imperial Museum; see Brauer.[7] The type of *xanthorhina* is in Mr. J. E. Collin's collection, but he writes me that it has been loaned for study; he thinks it the same as *M. cruciata* Townsend, but I do not venture to change the name until the type is examined.

Calliphora femorata WALKER, Trans. Ent. Soc., n. ser., vol. 5, 1858, p. 310.

From Mexico. Major Austen has examined the type, and writes me that it is a *Hemilucilia;* from this I should judge it a synonym of *segmentaria.*

Ochromyia fuscipennis MACQUART, Dipt. Exot., vol. 2, pt. 3, 1843, p. 292, female, pl. 17, fig. 2.

From Brazil. Only 8 mm. long, and the figure shows an appendage to the fourth vein at the bend. However, the description reads much like a *Mesembrinella,* and Macquart compares the specimen with *bicolor* Fabricius. Can not be identified from the description.

Ochromyia gigas MACQUART, Dipt. Exot., Suppl., vol. 1, 1846, p. 324, pl. 17, fig. 9.

From Brazil. Almost certainly not a *Mesembrinella,* as the colors are yellow and black, with no reference to blue or green; 16 mm. long; abdomen yellow, with black apex, segments 1–3 with small median dorsal spot at hind edge.

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[6] Sitzungsber. Kais. Akad., vol. 106, p. 526.

[7] Idem., vol. 104, 1895, p. 596.

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ON SIDERITE AND ASSOCIATED MINERALS FROM THE COLUMBIA RIVER BASALT AT SPOKANE, WASHINGTON.

By Earl V. Shannon,

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INTRODUCTION.

Some years ago Mr. Henry Fair, of Spokane, Washington, noted that the rock of the Columbia River lava flows being excavated in the city of Spokane contained vesicular cavities in which were developed unusual minerals, most abundant and conspicuous among which was siderite in the peculiar spherical forms commonly called sphaerosiderite. Mr. Fair carefully selected a large collection of the best of the specimens of this material for preservation in the Eastern Washington State Museum and a number of duplicates was sent to the New York Mineralogical Club for distribution among the members. One specimen from this lot was sent to the National Museum by L. P. Gratacap. An analysis of the siderite having been made by J. P. Maider, city chemist of Spokane, the optical properties were measured by Larsen and the data published by Wherry and Larsen.[1] These results have since been again used by Gaubert.[2]

Mr. Fair has desired that the material be given a more general and detailed study and that, if of sufficiently general interest, the results be published. To this end he recently donated a representative series of specimens from the locality to the National Museum. These have been studied in the Museum laboratory, with results as below.

The minerals identified include feldspar (oligoclase-andesine), magnetite, cristobalite, siderite, pyrite, iron opal, hyalite, calcite, aragonite, barite, limonite, and goethite. One of the most interesting though least conspicuous of these is the cristobalite, which occurs in well-formed crystals which it has been possible to measure on the goniometer. The paragenesis and association of the minerals of the

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[1] Edgar T. Wherry and Esper S. Larsen. The indices of refraction of analyzed rhodochrosite and siderite. Journ. Wash. Acad. Sci., vol. 7, pp. 365–368, 1917.

[2] P. Gaubert. The indices of refraction of the rhombohedral carbonates. Bull. Soc. Franc. Min., vol. 42, pp. 88–120, 1919.

No. 2458.—Proceedings U. S. National Museum, Vol. 62, Art. 12.

cavities are subjects of some interest, especially since the minerals of the vesicular cavities of the basalt of this great area have heretofore been given little attention.

Grateful acknowledgment is due Mr. Fair for his part in discovering and making available the materials for study and in furnishing information relative to their occurrence. With the single exception of the cristobalite all of the minerals mentioned were correctly identified by their collector.

As a preliminary to the description of the minerals of the basalts it is considered pertinent to offer a summary of available information relative to this great area of lava flows known collectively as the Columbia River Basalt Plateau.

THE COLUMBIA RIVER BASALT.[3]

The Columbia Basalt area, including the Snake River lava of Idaho, forms one of the greatest lava regions of the world, being comparable only to the Dekkan Traps of India, which cover about the same area and have a similar composition and many other features in common. The total area covered by the lavas has been variously estimated as from 200,000 (518,000 square kilometers) to 250,000 square miles (648,000 square kilometers), and includes the

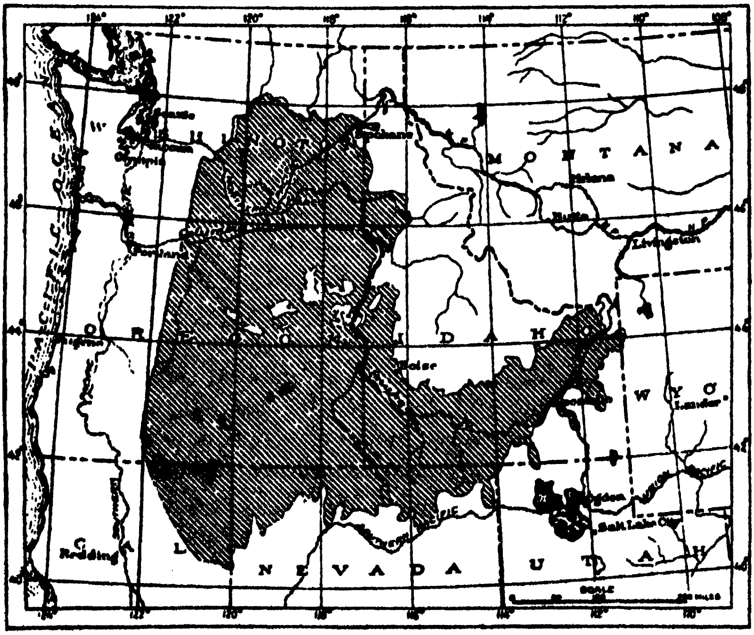

FIG. 1.—SHOWING APPROXIMATE EXTENT OF COLUMBIA RIVER BASALT AREA. (AFTER CAMPBELL. U. S. GEOLOGICAL SURVEY BULLETIN 611.)

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[3] This account and the accompanying figure 1 taken from M. R. Campbell. U. S. Geological Survey Bulletin 611, pp. 165–166, 1915.

greater part of Washington, all of eastern Oregon, much of northern California, and the great expanse of the Snake River Plain in Idaho. The approximate extent of the lava fields is shown in the accompanying map (fig. 1).

It is generally believed that the lava was poured out of open fissures and, being exceedingly fluid, spread widely in thin level sheets. This idea is based upon several lines of evidence: First, the volume and extent of the lava are so great that it is difficult to conceive their eruption from ordinary craters. Second, the rarity of the fragmental materials known as tuffs, breccias, etc., indicates a welling up through fissures without the explosive action characteristic of crater eruptions. Third, old fissures through which the floods of lava came forth have been discovered, fissures now filled with cooled and hardened basalt in observable connection with the overlying sheets of lava.

The basalt area is not a single flow but rather a complex of numerous relatively thin flows, the whole reaching in places a thickness of thousands of feet. About 20 separate flows are exposed in bluffs of the Columbia River. Each one represents a distinct outpouring of lava, the eruptions being separated by long periods of time, some of which must have endured for centuries, for they are marked by beds of soil in which trees grew to considerable size before being charred and buried by later flows. The eruptions of lava, especially in the later stages of activity, were separated also by periods in which other materials accumulated, consisting of volcanic ash and beds of sand, clay, and gravel laid down in lakes and rivers.

In addition to the massive flows that constitute the greater part of the material there are beds of fragmental volcanic material, such as bombs and smaller angular fragments of lava. Such materials have either been thrown up to great heights and rained down upon the surrounding country or, mixed with hot water, have flowed over the surface as mud. The fragmental materials are not as widely distributed as the massive flows.

The quantity of material poured out during this period was enormous. The greatest thickness of the lava and associated deposits is not less than 4,000 feet (1.25 kilometers), but if it averages only 500 feet (0.15 kilometer) over its entire area, seemingly a very moderate estimate, it would make a mass of 24,000 cubic miles (100,000 cubic kilometers) or a cube nearly 30 miles (48 kilometers) in height. Even this great volume may be far less than was actually poured out.

GEOLOGY OF THE CITY OF SPOKANE.

The geology of the city of Spokane has not been mapped in detail, although many geologists have worked in the surrounding territory and have examined the rocks in the city casually. The basalt is exposed in many places in street and railway cuttings and it is from these exposures that the minerals described below have come. At Division Street and Mallon Avenue, which are shown in the photographs reproduced as Plate 1, two distinct flows of basalt are exposed. At the point marked (*x*) at the right of the lower picture there was found between the flows a portion of a tree trunk 10 feet (3 meters) in diameter and 5 feet (1.5 meters) long, charred at one end. Dr. Frank H. Knowlton identified this wood as belonging to the genus *Sequoia* but of undeterminable species. The wood is dark, hard, and somewhat brittle, resembling ebony more than redwood, but it is so well preserved that the log was sawed into boards which were made into a box. Although some coaly material may be seen in the pores, the wood is not conspicuously lignitized. Spokane is practically at the eastern limit of the basalt area and the lava here is relatively thin, and hills of older rocks project through it in places. The very fluid material filled the floor of Spokane Valley extending up to Coeur d'Alene Lake and for many miles up the tributary Coeur d'Alene and St. Joe Valleys, giving these tortuous canyons a level floor of solid stone. This has been cut through by later erosion, and the basalt remains as flat topped terraces along the valley sides.

Mr. Fair reports that certain wells sunk in the city of Spokane have penetrated 264 feet (80 meters) of basalt and 286 feet (87 meters) of silt and have been drilling for 500 feet (152 meters) in granite in search of oil. The silt which underlies the basalt is apparently a lake deposit formed in water ponded by damming of the Spokane Valley by earlier flows of the lava and covered by the later flows. It has been found to contain abundant plant remains which are of Upper Miocene age.

The rock of the flows in Spokane varies from spongy material, in which half the volume is occupied by irregular open cavities, to dense compact granular basalt which shows typical columnar structure. In places the material from surfaces of flows is glassy, forming a basaltic obsidian, and there are occasionally inclusions of mud.

PETROGRAPHY OF THE BASALTIC ROCKS.

The specimens of Spokane basalts submitted to the writer for examination are varied in appearance, but those which enclose the vesicles containing minerals are all of two major varieties characterized as light and dark basalt by Mr. Fair. Both of these are equigranular moderately fine-grained holocrystalline rocks. The light-colored variety is light gray in color and granular in structure with a harsh lusterless surface on fresh fracture. It is perfectly fresh with no sign of alteration. As contrasted with this the dark-colored variety has a dark greenish brown color, greasy luster, and dense conchoidal fracture. In thin section under the microscope the fresh gray rock of the light variety is seen to be a normal basalt consisting of twinned laths of plagioclase in a mesh of perfectly fresh augite, the texture being typically ophitic, although some of the pyroxene grains have a tendency to euhedral development. Large euhedra of iron ore are scattered throughout the section, and there occurs interstitially a moderate amount of brownish glass filled with minute acicular microlites.

The sections of the dark rock show only one essential difference from those of the light rock. This dark rock is composed of the same perfectly fresh assemblage of plagioclase, which by its extinction angles is shown to be bytownite, with augite and accessory iron ore and glass. Throughout the rock, however, there are interstitial areas of a transparent yellow-brown isotropic material having an index of refraction of 1.432 to 1.438, which is evidently opal colored by hydrated ferric oxide. The opal occupies the same relative position as the glass with relation to the other constituents, and it may represent an alteration product or replacement of the glass. That this material is not merely glass stained by iron is shown by its much lower index of refraction. The microlites which are present in the glass do not occur in the opal. The other constituents of the rock are free from any sign of alteration or staining, and areas of glass which still remain in the sections which contain the opal show no incipient or partial replacement by the opal.

THE VESICULAR CAVITIES.

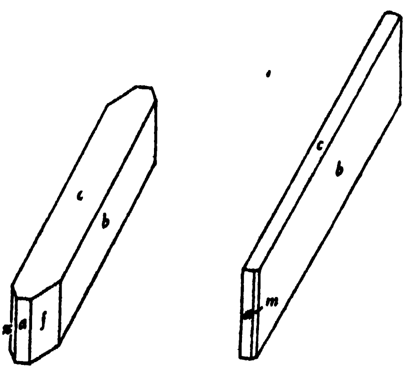
The cavities are varied in size from minute to some which are 15 cm. or more in diameter. They are most abundant in the more glassy forms of the basalt, but the larger ones are in the dense crystalline rocks. Many of these vesicles are nearly spherical and represent typical gas bubbles, while others are much flattened and deformed as though by movement after the enclosing lava had become very viscid. It is with the several minerals which occur in these cavities that this paper has chiefly to do. These are described in some detail below, even though the majority of them are not particularly rare or remarkable species. The minerals are, with one or two exceptions, discussed essentially in the order of their deposition.

PLAGIOCLASE (OLIGOCLASE-ANDESINE).

The first lining of the vesicles of the freshest rock is composed either of a grayish glassy enamel-like coating or of a crust of distinctly lath-like crystals of plagioclase. The largest of these feldspar crystals reach 2 mm. in length. Upon microscopic examination the gray glaze is found, like the crystals, to consist of feldspar, there being no isotropic material present in the enamel. Every gradation exists between the gray enamel and the crystal crusts, intermediate forms appearing like crystals which had partly fused. The lowest index of refraction of the feldspar, *a*, is 1.5400, and this together with its extinction angles identify it as oligoclase-andesine as contrasted with the much more basic bytownite of the enclosing basalt. One rather imperfect crystal which was measured on the goniometer had the habit shown in figure 2, the forms identified being as shown, *c* (001), *b* (010), *a* (100), *f* (130), and *z* ($\bar{1}$30). Another common form is shown in figure 3. While the combinations are simple, the crystals vary widely in proportions, ranging from slender acicular by elongation on axis *a* to very broad and thin tabular to the pinacoid *b* (010). Twins on *b* (010) are common (albite law), and a crystal twinned on *c* (001) was seen (Manebach law).

MAGNETITE.

Magnetite is invariably present as minute sharp and brilliant crystals interspersed with the lath-like crystals of plagioclase in the cavities. The crystals are always simple octahedrons, often with depressed faces, as shown in figure 4. The most noteworthy thing about the minute magnetite crystals is their tendency to align themselves in strings in parallel position, as shown in figure 5.



2. 3.

FIGS. 2-3.—COMMON HABITS OF PLAGIOCLASE CRYSTALS FROM BASALT.

CRISTOBALITE.[4]

Cristobalite, the pseudoisometric form of silica, was first named by G. vom Rath[5] from material from Cerro de San Cristobal, Hidalgo, Mexico, where it occurs as octahedral crystals up to 2 mm. in size and as spinel twins up to 4 mm. in diameter associated with tridymite, hornblende, and hematite in cavities in augite andesite. Although giving the form a new name, vom Rath himself was inclined to believe it to be either pseudomorphous after some isometric mineral, such as spinel, or to be merely a form of tridymite which had assumed a pseudoisometric form by twinning, Indeed he had previously described in detail cuboctahedral forms of "tridymite" from New Zealand, which, as discussed below, were doubtless cristobalite. The same writer also identified as cristobalite a mineral from the lava from Ettringen described by Wolf[6] and by Lehmann[7] as druses with white or yellowish octahedrons and spinel twins. Lacroix[8] found cristobalite with quartz and tridymite in cavities in the basaltic rock from Mayen, and Gaubert[9] found one-half mm. cristobalites in lavas from Mayen and Niedermendig. Lacroix[10] found cristobalite octahedrons with tridymite in volcanic blocks from the St. Vincent eruption of 1902–3.

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[4] A preliminary note on the cristobalite has been published. Earl V. Shannon. Journ. Wash. Acad. Sci., vol. 12, pp. 195-196, 1922.

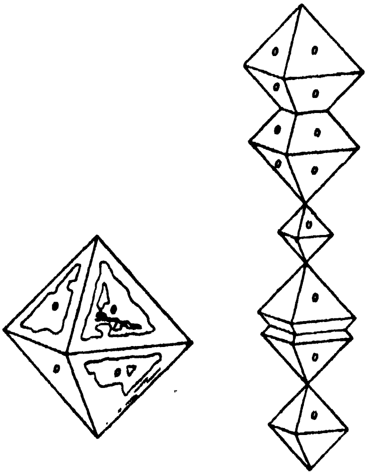
[5] G. vom Rath, N. Jahrbuch, 1887, pt. 1, p. 198.

[6] Th. Wolf. Zeits. der Geol. Gesellsch., 1869, vol. 20, p. 16.

[7] J. Lehmann. Ver. Nat.-List. Ver. Rheinl., Bonn, 1874, p. 35.

Cohen[11] has reported cristobalite with carbon and schreibersite, as sharp crystals 0.01 to 0.09 mm. in size, showing the cube either alone or with the octahedron, in the meteoric iron of Kendall County, Texas. Aside from this occurrence in meteoric iron, which must be considered as requiring confirmation, the first recognition of the occurrence of this mineral in the United States was by Rogers,[12] who identified cristobalite in volcanic rocks from two localities in California and associated with orthoclase rods in spherulites in obsidian from Yellowstone Natonal Park.[13] The latter cristobalite is fairly abundant in spherical aggregates 0.3 mm. in diameter and is subtranslucent with an enamel-like appearance. Under the microscope it is faintly birefringent, with a complicated mosaic structure, and shows polysynthetic twinning in spots. The refractive index is 1.485 ± 0.005. Upon heating, the mineral became translucent and upon cooling reverted again to the subtranslucent form. Later Rogers has mentioned still a third California locality for this mineral.[14]

While the earlier authors were inclined to regard cristobalite as either a pseudomorph after an isometric mineral or as a mimeoisometric aggregate of twinned tridymite crystals, the mineral is now regarded as a well-substantiated species. Its synthesis has been effected by several investigators, and the results of Fenner,[15] being the most recent and complete, may be summarized here. In general silica heated with a flux (either sodium tungstate or alkaline



4. 5.

FIGS. 4–5.—MAGNETITE FROM BASALT CAVITIES. 4, COMMON OCTAHEDRAL FORM SHOWING DEPRESSED FACES. 5, SHOWING A NUMBER OF OCTAHEDRONS ALIGNED IN PARALLEL POSITION.

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[8] Albert Lacroix. Bull. Soc. Min., Paris, 1891, vol.14, p. 185

[9] P. Gaubert. Bull. Soc. Min., Paris, 1904, vol. 27, p. 242.

[10] Albert Lacroix. Bull. Soc. Min., Paris, 1905, vol. 28, p. 59.

[11] Ann. Naturhist. Hofmus. Wien., 1900, vol. 15, p. 385.

[12] Austin Flint Rogers. Amer. Journ. Sci., vol. 45, p. 222, 1918.

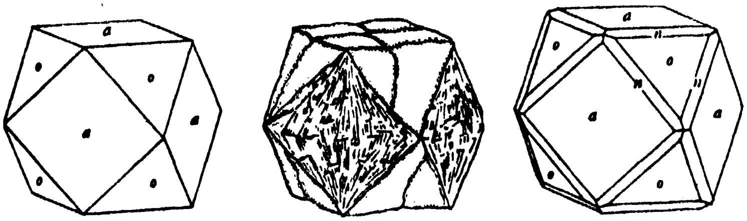
[13] Austin Flint Rogers. Amer. Mineral., vol. 6, p. 4, 1921.

[14] Austin Flint Rogers. Amer. Mineral., vol. 6, p. 60, 1921.

[15] Clarence N. Fenner. The stability relations of the silica minerals. Amer. Journ. Sci., vol. 30, 1913, p. 331.

silicate glass was used) crystallizes as quartz below 870°. Although quartz is the stable form below this temperature, either amorphous silica or cristobalite changes first to tridymite and then to quartz only after much longer heating. Between 870° and 1,470° tridymite is always formed in a tungstate melt. Within the tridymite range amorphous silica heated in fused sodium tungstate or alkali silicate yields at first a mixture of cristobalite and tridymite, which later becomes entirely converted to tridymite. From 1,475° upward any form of silica heated in a tungstate melt is change to cristobalite. Heated without a flux quartz is changed to cristobalite, while quartz and tridymite are never formed in the absence of a flux. In addition to these inversions, which are marked by a complete change of crystalline form and which take place slowly and with difficulty, there is another class of inversions of different character which take place with no notable change in the outer form of the mineral. Cristobalite is isometric in form but is always feebly birefringent and uniaxial optically. The isometric form is stable only at an elevated temperature and inverts upon cooling to the double-refracting pseudoisometric form. These are known as α- and β-cristobalite, respectively. Thus an ordinary birefracting crystal of α-cristobalite heated to a moderate temperature, 300° or slightly less, becomes converted to more transparent isotropic β-cristobalite, which on cooling reverts again to the birefracting α-cristobalite. The variability of the temperature at which this inversion takes place has been discussed in the paper cited and need not be gone into here. The optical and physical properties conclusively isolate cristobalite from the other modifications of the compound SiO_2.

In those specimens of light-colored nonopalized rock from Spokane which show plagioclase crusts or coatings of the gray enamellike feldspar there occur, associated with the octahedrons of magnetite and attached to the plagioclase or the gray glaze, small whitish crystals or rounded bodies of a porcellanous white mineral agreeing in appearance with the cristobalites described by Rogers. When boiled in hydrochloric acid, these show no tendency to dissolve. This mineral, which had provisionally been called analcite by Mr. Fair, was examined optically by Mr. A. Rodolfo Martinez in this laboratory and found to agree with cristobalite in optical properties, its mean refractive index being 1.485 ± 0.003. The mineral occurs in whitish crystals averaging 0.5 mm. in diameter, which under a binocular microscope were seen to vary from simple forms to almost spherulitic bodies. In some ways the least simple of these resemble complex penetration twins which could not be interpreted. Occasional crystals, though dull, have the perfect cuboctahedral form shown in figure 6. Most of those which are of this form are also imperfect, and one which was mounted on the goniometer gave no dependable angles. One face, which was taken as the top cube face (001) and mounted as polar, was found to be depressed and concave and to be divided into four sectors by irregular sutures which yielded four major and numerous minor signals. The octahedral faces were bright enough to reflect, but each of these was found to consist of two or more areas yielding separate signals. The measurements were entirely unsatisfactory, and the vertical faces of the cube were apparently composed of numerous projecting points with shallow reentrant angles. A sketch of a crystal of this sort is given in figure 7. Such forms grade intermediately between the simple crystals and the spherical forms which are characteristic of this mineral at many localities. An excellent idea of the appearance of the cristobalite under a lens can be gained from the photograph, (pl. 2, left), which shows a small cavity in the basalt containing cristobalite associated with rods of feldspar and globules of first generation siderite, the photograph being enlarged six diameters. The most perfect crystal shown in this photograph was removed and measured on the two-circle goniometer, the results being satisfactory in that they indicated



6. 7. 8.

FIGS. 6-8.—CRISTOBALITE CRYSTALS FROM BASALT. 6, SIMPLE CUBOCTAHEDRON SHOWING FORMS A (100) and O (111). 7, SKETCH OF IMPERFECT CUBOCTAHEDRAL CRYSTAL. 8, CUBOCTAHEDRON WITH EDGES BEVELED BY TRAPEZOHEDRON N (211.)

isometric symmetry conclusively. This crystal, as shown in figure 8, was cuboctahedral, but with the edges beveled by the trapezohedron *n* (211) and with no external indication of any twinning. The following measurements were obtained:

Angles measured on cristobalite crystal, figure 5.

No.	Form.	Signal.	Measured.				Calculated.			
			φ		ρ		φ		ρ	
			°	′	°	′	°	′	°	′
1	*c* 001	Fair	0	00	0	00	....		0	00
2	*o* 111	Poor	44	17	53	16	45	00	54	44
3	*o* 111	Fair	44	36	54	28	45	00	54	44
4	*o* 111	Fair	45	20	54	28	45	00	54	44
5	*o* 111	Poor	44	18	54	28	45	00	54	44
6	*a* 100	Good	90	00	90	00	90	00	90	00
7	*n* 211?	Very narrow, no signal	44	40	[1] 29	20	45	00	35	16

[1] Measurement obviously erroneous. Indices established by zonal relations.

Although cristobalite is described as twinning frequently on the spinel law, no spinel twins were found in the Spokane material. The more complex forms of the Spokane cristobalite look so like repeatedly twinned tridymite crystals that, were it not for the unavoidable evidence of the optical properties, one might be tempted to follow vom Rath's earlier example and endeavor to interpret them as twinned tridymite. Previous to his assigning the name cristobalite vom Rath had described apparently isometric silica crystals from New Zealand, which had almost identically the habit of those from Spokane. The occurrence is at Littleton Harbor, near Christchurch in Canterbury, New Zealand.[16] Here a highly crystalline grayish-white layer between beds of basaltic andesite contains vesicles which are invariably lined with a crust of 2 mm. tridymite crystals, sometimes with some quartz. The writer states that some of the crystals in part appear isometric with the cube and octahedron in equal development. Occasionally these show skeleton structure, and they appear to grade into ordinary aggregates of twinned plates of tridymite. The pseudoisometric form is explained as twinning of tridymite on r $(30\bar{3}4)$ combined with trilling on q $(10\bar{1}6)$. It is obvious that these cuboctahedral crystals of vom Rath are entirely similar to those in the Spokane specimens, although no tridymite has been found in the latter. The complicated and improbable explanation of the origin of the isometric forms is no longer necessary in view of the fact that an isometric form of silica has been proven to exist.

It is obvious that in the vesicles of the Spokane basalts the cristobalite, like the plagioclase and magnetite, is a high-temperature mineral deposited during the period immediately following consolidation of the inclosing rock. This need not necessarily indicate, however, that its formation took place at a temperature above 1,470°, as might be inferred from Fenner's work on dry melts, as abstracted above. The presence of volatile constituents in the vesicular cavities, during formation of the minerals forming the crust, may have greatly altered the physical requirements for their crystallization.

PYRITE.

Pyrite was seen to occur sparingly in several specimens and in moderate abundance in one. Aside from recording its presence and position with reference to the other minerals it does not require special description. It is confined to the nonopalized rock and forms thin coatings over the feldspar or feldspar-enamel crusts. In age it is later apparently than the first generation of sphaerosiderite and earlier than the iron opal. In the specimen showing it most abundantly the pyrite coated the gray feldspar glaze completely in places and occurred as isolated patches on the siderite spheres. Apparently the tendency was toward selective deposition on the feldspar in preference to the siderite. The pyrite forms mossy coatings which show no evidences of crystal form. It commonly shows a deep bronzy tarnish.

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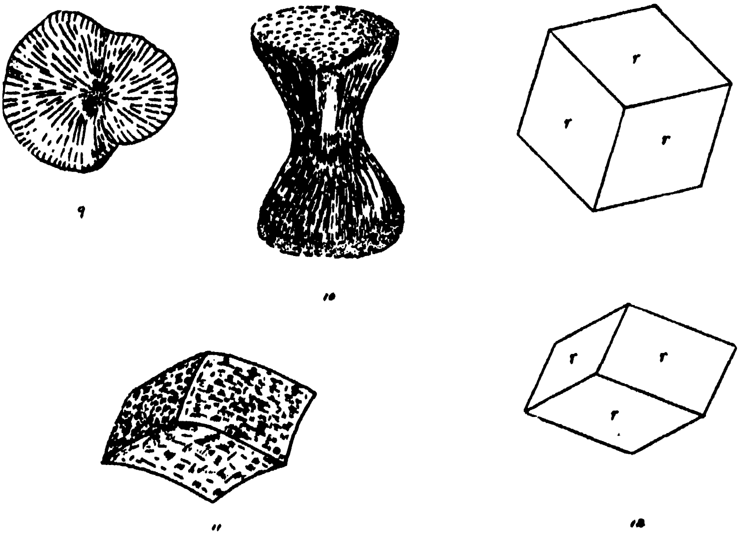
[16] G. vom Rath. Zeitschrift Karystallographie, vol. 13, p. 569.

SIDERITE (SPHAEROSIDERITE).

The most conspicuous and most universally distributed mineral of the cavities is the siderite, which first attracted attention to the minerals here described. While siderite in the ordinary cleavable granular form is a common enough mineral, that in the basalt cavities is the variety which, on account of its peculiar concretionary form, is known as sphaerosiderite. Careful study of the specimens at hand



Figs. 9–12.—Siderite from Spokane 9, Radiate form of first generation siderite. 10, Common "trigonal hour-glass" form of first generation siderite. 11, Curved crystal of second generation siderite. 12, Crystal drawings in orthographic and clinographic projections of crystal of siderite.

indicates that the siderite is of two distinct generations separated by iron opal. These may conveniently be considered separately.

The siderite of the first generation is widely distributed on the perfectly fresh nonopalized basalt, where it occurs always in small bodies more or less thickly scattered over the plagioclase crust. In size these range from very minute up to perhaps a maximum diameter of 3 mm. In color they are light yellowish to pistachio green, and they are nearly opaque with a waxy to velvety luster. Many of these siderite masses are almost perfect spherulites or aggregates of the same, but a great number also has a peculiar trigonal hourglass form, in general resembling that shown in the drawing, figure 10. Occasionally some of these are bronze brown externally and beautifully iridescent, apparently from very slight surface alterations.

The second generation siderite, as contrasted with that of the first generation, occurs much more abundantly in its specimens and as much larger masses, the individual spheroids reaching an extreme observed diameter of 4 cm. It is much more translucent than the early variety and has a darker olive-green color. This siderite of the later generation is always, so far as seen, deposited in cavities in the rock which is dark colored by reason of having undergone opalization, and the siderite in the cavities is practically always underlain by a thin film of the ferric opal.

A cavity may contain only a single globe of siderite, or it may be almost completely filled with crowded units (pl. 2). Not infrequently the spherulites have grown in linear arrangement and by their union have produced peculiar caterpillarlike forms, as shown in plate 2, lower. The surfaces of these dark-colored second-generation nodules of siderite are usually velvety in appearance or in some cases remarkably and beautifully iridescent. Chance fractures show the nodules to have a radiate fibrous internal structure, although this is masked in most cases by the perfect rhombohedral cleavage of the mineral, yielding curved cleavage surfaces. Cross sections of the spheres when examined in polarized light show a homogeneous radiate fibrous structure in which individual fibers are so minute as to be indistinguishable. Between crossed nicols the nodules do not extinguish, but yield the dark extinction cross characteristic of very finely fibrous spherules. There is no indication of concentric structure indicating periodic growth or interrupted deposition of the siderite, nor are there any inclusions in the section, although one sample analyzed was found to include a flake of hyalite, though its surfaces were entirely cleavages. The optical properties of a nodule of second-generation siderite were determined by Larsen, who found the indices of refraction to be $\omega = 1.851$ and $\epsilon = 1.612$.

Four analyses of the Spokane siderite have been made with the results tabulated below:

Analyses of sphaerosiderite from Spokane.

	1	2	3	4
$FeCO_3$	93.49	91.96	92.41	93.35
$MnCO_3$	Trace.	.70	1.43	.73
$CaCO_3$	5.13	5.51	3.74	3.13
$MgCO_3$	1.83	2.53	3.10	3.00
Total	100.45	100.70	100.68	100.21

(1) Analysis by J. P. Maider, city chemist of Spokane, probably second generation.

(2) Average of two analyses by the writer made upon a second-generation nodule 1 cm. in diameter from which a thin section was cut.

(3) Analysis by the writer on second-generation nodule 2 cm. in diameter.

(4) Analysis by the writer of several small spherules of the light-colored first-generation siderite.

As shown by these analyses the material is ferrous carbonate with minor amounts of lime and magnesium carbonates and a very little manganese carbonate. The variation in composition from cavity to cavity is slight, and there is no essential difference in composition between the siderite of the first and second generations.

In only one specimen were simple crystals of the siderite found. These were yellowish translucent unit or cleavage rhombohedrons showing only the form *r* $(10\bar{1}1)$, as shown in sketch in figure 11 and in orthographic and clinographic projection in figure 12. These crystals, which averaged 2 mm. in diameter, occur scattered over the brown opal layer between nodules of ordinary second-generation sphaerosiderite.

In one specimen only is there evidence of a third growth of siderite, although the crystals noted above may belong to a period of deposition later than that of the second-generation nodules. In the specimen mentioned a cavity contains a dozen spheres of ordinary second-generation sphaerosiderite averaging 6 mm. in diameter, which rest, as usual, upon the brown opal crust. Coating the exterior of these spheres and evidently a later growth is a crust, 0.75 mm. in average thickness, of crystalline siderite made up of innumerable closely crowded rhombohedral crystals one-fourth mm. in diameter. The crystal crust is loosely attached to the earlier nodules and can be easily scaled off. The smooth surfaces of the original nodules are coated with a layer or film of rusty limonite, which looks as though some oxidation had taken place before the deposition of the crystal crust of the siderite. Scattered over the opal between the nodules are several typical saddle-shaped groups of small translucent brown rhombohedral siderite crystals.

The form of these siderites is that of typical sphaerosiderite. While botryoidal forms are not rare in other carbonates of the same group, being characteristic especially of smithsonite, these forms, for smithsonite at least, grade imperceptibly into the crystalline-euhedral modifications. Such botryoidal, mammillary, and spheroidal forms have been called colloform by Rogers[17] because they are the forms assumed by colloids, which are devoid of any definite tendency to assume crystal form, and thus tend to form spheres. As has previously been pointed out, minerals form spherical bodies because they were deposited first as colloids and have retained the colloidal form after crystallization. As perhaps the most typical example of this process chalcedony may be mentioned. This mineral, though now crystalline, owes its form undoubtedly to its being originally deposited as opal, and the rearrangement during crystallization has not been sufficient to destroy the original form. On the other hand, some minerals form spherical bodies when deposited in crystalline form by reason that a large number of crystal units started growth in a narrow space, and the mutual interference during growth has compelled growth to take place all in one direction, resulting in radial-fibrous spherical bodies. The exteriors of such bodies are usually covered with euhedral terminations of the crystals making up the spherical mass. A study of the Spokane siderites from this standpoint leads to the conclusion that the iron carbonate was in colloidal form when deposited, a conclusion sustained by the perfectly spherical form taken by a majority of the nodules, their entire homogeneity, lack of concentric rings, fineness of fibrous structure, and the absence of crystal terminations on their exterior. On the other hand, the apparently third-generation drusy crust on the siderites of one nodule was doubtless deposited in crystalline form.

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[17] Austin F. Rogers. A review of the amorphous minerals. Journ. of Geol., vol. 25, 1917, p. 514.

The sphaerosiderite variety of iron carbonate is known from a number of localities in Europe, but no previous locality comparable to these European occurrences has been found in the United States. At Felsobanya in Hungary typical spherical bodies of siderite occur in veins with ore minerals, but the typical European occurrences are, like the one at Spokane, in vesicles in basaltic rocks. A specimen in the National Museum from Steinheim, Hesse, Germany (Cat. 78,837), is so similar to those from Spokane as to be indistinguishable without microscopic examination of the enclosing rock.

FERRICALCITE.

One specimen, which when received was labeled "Pseudomorph after siderite," consists of the dark-colored opalized rock containing a cavity of the usual type lined with the ferric opal. In this cavity is a single roughly spherical nodule about 17 mm. in diameter, which has a light buff color and velvety surface. When fractured, the interior is white, compact, dense-fibrous, and tough. Fragments dissolve quickly with effervescence in cold dilute hydrochloric acid. Upon standing in the air fresh surfaces begin to turn buff immediately. C. S. Ross, upon microscopic examination found this material to have optical properties intermediate between those of calcite and siderite, and it is evidently an intermediate lime-iron carbonate. It is not probable that this represents a replacement of an original siderite nodule, but it more probably represents local variation in the composition of the carbonate-depositing solutions. It is possible that it represents an outer deposit and that a nodule of the ordinary siderite is enclosed within the ferriferous calcite nodule; but this could not be determined without destroying the specimen, which is the property of the Eastern Washington State Museum.

OPAL.

At least two varieties of opal are abundantly present in the specimens. The first of these, which has been referred to as iron opal, occurs throughout the cavities which contain the large second-generation siderites as a thin botryoidal layer underlying the siderite. It also occurs interstitially in the enclosing rock, constituting a particular and typical form of alteration or opalization. In the hand specimen this opal is dark brown to black in color with greasy, pitchy, or velvety dull luster. Under a lens it is seen to have a minute botryoidal surface. It coats the earlier minerals, feldspar, magnetite, cristobalite, and first-generation siderite. The dark-brown color is doubtless due to ferric hydrate, indicating that the opal was formed in the presence of free oxygen; but the solutions which deposited it in the cavities were not oxidizing, since the minute siderite globules beneath the opal layer are not oxidized, Under the microscope the opal is transparent, reddish brown to golden brown in color, and devoid of any cleavage or inclusions. It is completely isotropic with an index of refraction of 1.445 ± 0.003. The material varies somewhat in index, however, that in the fabric of the basalt running down as low as 1.432 ± 0.003.

The second variety of opal is perfectly limpid colorless hyalite which was deposited later than the second-generation siderite, although it is not confined to the cavities containing this siderite, but sometimes coats first-generation siderite in nonopalized light-colored basalt. Its perfectly limpid transparent botryoidal crusts vary from exceedingly thin to a thickness of 3 mm. or more (pl. 3, upper). It may occur coating the entire interior of a cavity, being deposited impartially on all of the minerals, or it may be dotted in minute limpid drops over the surfaces of the siderite. In one or two specimens the hyalite appears to be earlier than the second-generation siderite, but this is due apparently to its depositing over the space between the siderites and avoiding them. The opal is later than the aragonite in the single specimen in which both occur, and long acicular aragonite crystals bear a bead of hyalite at their termination. Under the microscope the hyalite is transparent and colorless. It is feebly birefringent and has an index of refraction of 1.455 ± 0.003.

ARAGONITE.

Aragonite occurs as a constituent of two specimens. One of these is a rosette of long prismatic crystals of aragonite, which shows no basalt attached, nor does it show any of the other characteristic minerals, so that its relationships are not known. The crystals are repeatedly twinned and have obscure terminations resembling fractures. Little could be learned from a crystallographic study. The second specimen shows aragonite in minute acicular crystals and crystalline masses resting on iron opal in a cavity in black vitreous basalt. The aragonite is partly coated by hyalite. The crystals are too minute and imperfect for measurement.

CALCITE.

Calcite was noted only once as a snow-white nodule in a cavity in rather dense basalt from the Spokane River at Wall Street. The snow-white nodule rested lightly on several chain aggregates of second-generation siderite. The interior structure of the nodule was radial-fibrous, and it was very friable, the fibers separating readily. It was readily soluble in cold dilute acid. Measurement of the indices of refraction showed that this carbonate was calcite rather than aragonite. While the exterior of the nodule bristled with minute terminations, these were etched dull and no measurements could be made.

BARITE.

Barite occurs in only one specimen, where it is abundant as a crust of acicular colorless crystals up to 2 mm. in length. It is associated with both second-generation siderite and hyalite, and although it is later than both of these it has deposited between them on the lining of the cavity in preference to resting on either. Under a lens the barite resembles quartz to a remarkable degree. Under the microscope crystals resting on a tabular face of *c* (001) show the emergence of the obtuse bisectrix, and well-defined cleavage parallel to *m* (110). The orientation adopted in the drawings gives optical orientation in agreement with the data given for barite, while one index on such a section is higher and one is lower than 1.640. The resemblance to quartz crystals is heightened by tapering of the crystals, this distortion amounting to 10° or more, as shown in the drawing, figure 13. The most highly modified crystal seen had the development shown in figure 14. The smaller faces are very minute and give very faint signals, while the distortion mentioned affects the angles. The measurements obtained on the crystal (fig. 14), are given below:

Forms and angles of barite crystal from Spokane.

Letter.	Miller.	Reflection, etc.	Measured.		Calculated.	
			φ	ρ	φ	ρ
			° ′	° ′	° ′	° ′
c.....	001	Very good....................	.. ..	0 00	.. ..	0 00
b.....	010	Bright narrow line...........	0 07	90 00	0 00	90 00
m.....	110	Very good....................	50 49	90 00	50 49	90 00
η.....	320	Very minute, no signal......	59 06	90 00	61 28	90 00
λ.....	210	Small but bright.............	68 29	90 00	67 49	90 00
o.....	011	Blurred, distorted...........	5 00	52 40	0 00	52 43
u.....	101	Very faint, minute...........	88 08	61 26	90 00	58 10
d.....	102	Very good....................	89 33	39 01	90 00	38 51
W....	108	Poor, rounded................	88 16	12 51	90 00	11 23
z.....	111	Good.........................	50 52	64 20	50 49	64 18
y.....	122	Minute, faint................	28 54	56 44	31 31	57 01
ρ.....	144	Very poor, minute, rounded..	17 13	53 39	17 03	53 57
R....	223	Very poor, no signal.........	49 29	53 08	50 49	54 11

LIMONITE AND GOETHITE.

It remains only to describe the minerals formed by the alteration of the siderite under the influence of weathering, the ferrous carbonate being converted readily upon exposure to the hydrated ferric oxides limonite and goethite. These minerals form perfect pseudomorphs after the original siderite nodules, the oxidation having been accomplished with no alteration in volume. The limonite-goethite pseudomorphs are firm and hard, and thin sections and polished cross sections show them to preserve the internal structure of the siderite, the pseudomorphs being radially fibrous. The fibers are composed of crystalline goethite, while amorphous limonite occurs interstitially between the goethite fibers. The exteriors of the nodules of oxidized siderite are often smooth and glossy. In no case was a nodule seen only partly oxidized or with a core of unaltered siderite, the alteration apparently proceeding very rapidly under oxidizing conditions. In one specimen containing several cavities, in which were numerous small nodules of first-generation siderite, the

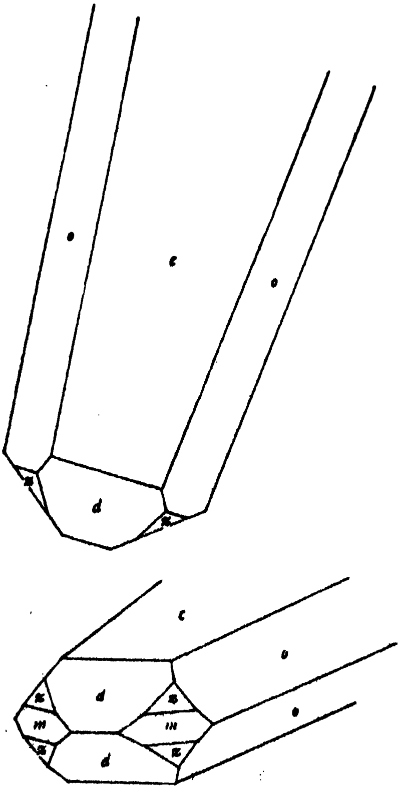


FIG. 13.—BARITE CRYSTAL FROM BASALT. SIMPLE CRYSTAL SHOWING TAPERING.

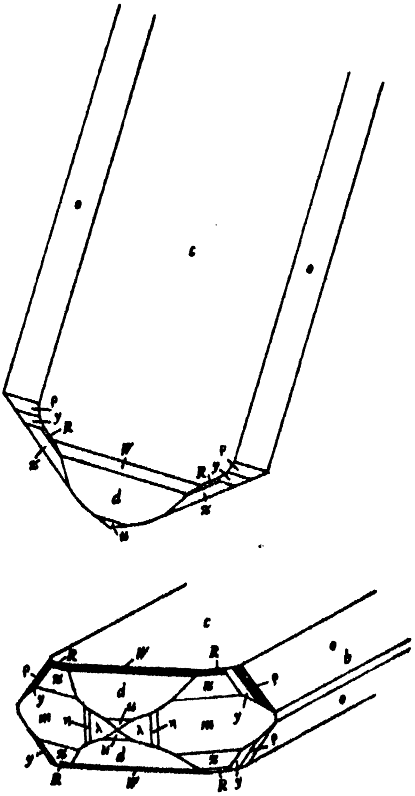


FIG. 14.—BARITE CRYSTAL SHOWING 13 FORMS. FROM BASALT.

siderites of one cavity were entirely oxidized while all of those of the other cavities were perfectly fresh.

PARAGENESIS AND DISCUSSION.

To summarize, the basalt cavities contain several minerals, which, beginning with the first, may be listed in the order of their deposition as follows:

1. Plagioclase, crystals and enamelliform.
2. Magnetite.
3. Cristobalite.
4. Siderite (sphaerosiderite), first generation.
5. Pyrite.
6. Iron opal.
7. Siderite (sphaerosiderite), second generation.
8. Ferricalcite.
9. Calcite.
10. Aragonite.
11. Hyalite.
12. Barite.
13. Goethite.
14. Limonite.

When one comes to assign a source to these several minerals, there develop difficulties in the shape of insufficient data, and opinions must be largely speculative. There can exist little doubt that the feldspar, magnetite, and cristobalite are high-temperature deposits formed in the cavities while the basalt was at an elevated temperature and very soon after its consolidation. Careful consideration has led to the conviction that the small spherulites of first-generation siderite are likewise intimately related to the cooling of the lava, although this mineral was probably formed at a somewhat lower temperature than the preceding ones. The pyrite, in view of its universal distribution and the fact that it does not occur in quantity, may be glossed over without discussion. With the iron opal, however, difficulties again become paramount. There is to be considered not only the film of this opal in the cavities but that which is developed in the enclosing rock, constituting a unique type of alteration, opalization, of the basalt. That this opal is colored by ferric oxide indicates that it was formed, or at least colored, in the presence of available oxygen. The opalization is a local phenomenon, as is the presence of second-generation siderite in the cavities, the two being coextensive. For the present it will be sufficient to remark that the opal has the appearance of a percolating water deposit, and its source may be connected with the underlying fine-grained silt. The same agency which deposited the opal doubtless also deposited the second-generation sphaerosiderite, and it is not improbable that this latter represents a concentration, by solutions, into favorable situations of the original or first-generation siderite from over a much wider area. Some change must have taken place in the solutions, since it is difficult to conceive solutions depositing ferric-iron opal and ferrous carbonate under the same conditions. The other minerals, aside from the hyalite, are very local and more or less adventive substances whose source must remain problematic. The limonite and goethite are distinct from the other minerals in that they are products of ordinary weathering.

EXPLANATION OF PLATES.

PLATE 1.

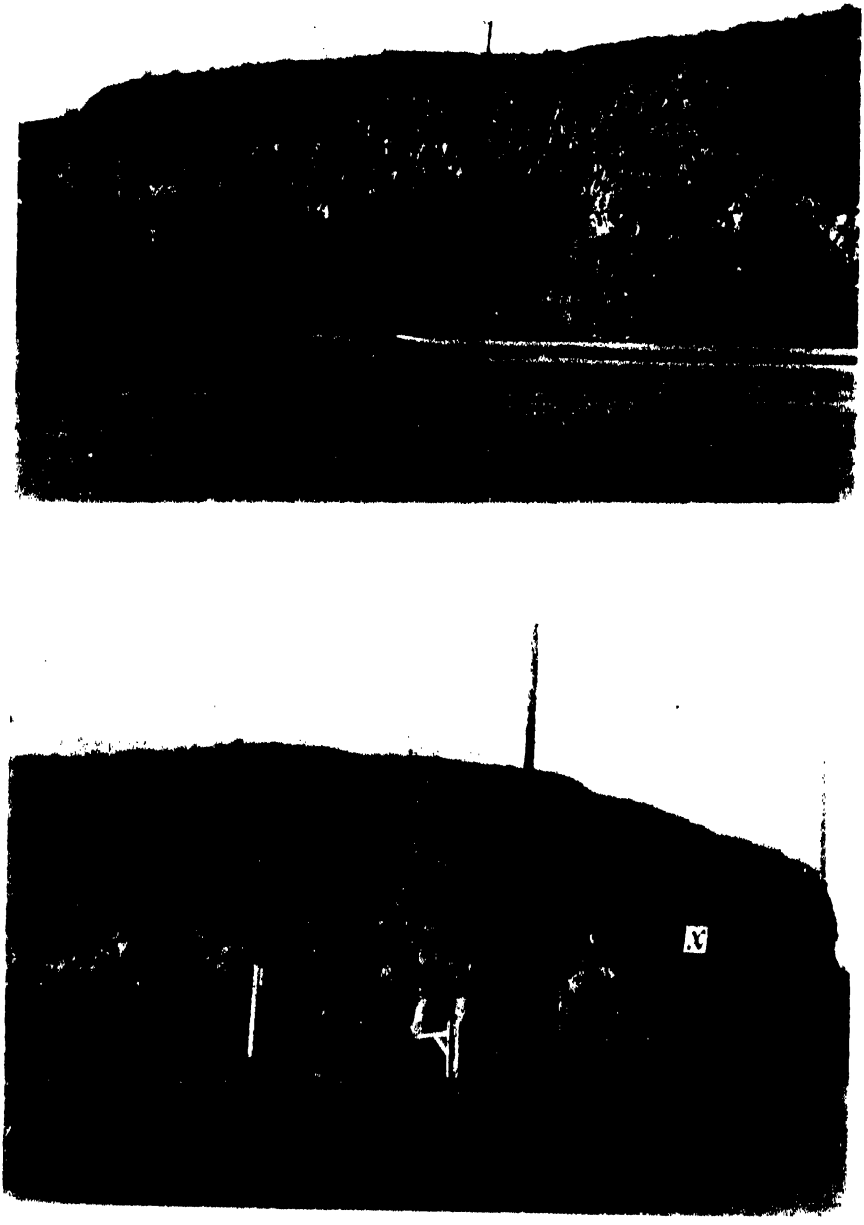
Two views of basalt exposure at Division Street and Mallon Avenue, Spokane. Two distinct flows are here represented. At the point marked (x) in the lower picture a portion of a trunk of Sequoia sp. was found between the flows.

PLATE 2.

Upper right: Photograph of cavity in basalt nearly filled with crowded spherical bodies of second-generation siderite. *Upper left:* Photograph of small cavity in basalt showing crystals of cristobalite associated with rods of feldspar and small masses of first-generation siderite. Enlarged 6 diameters. *Lower:* "Caterpillar-like form" produced by alignment of closely crowded units of siderite. Natural size.

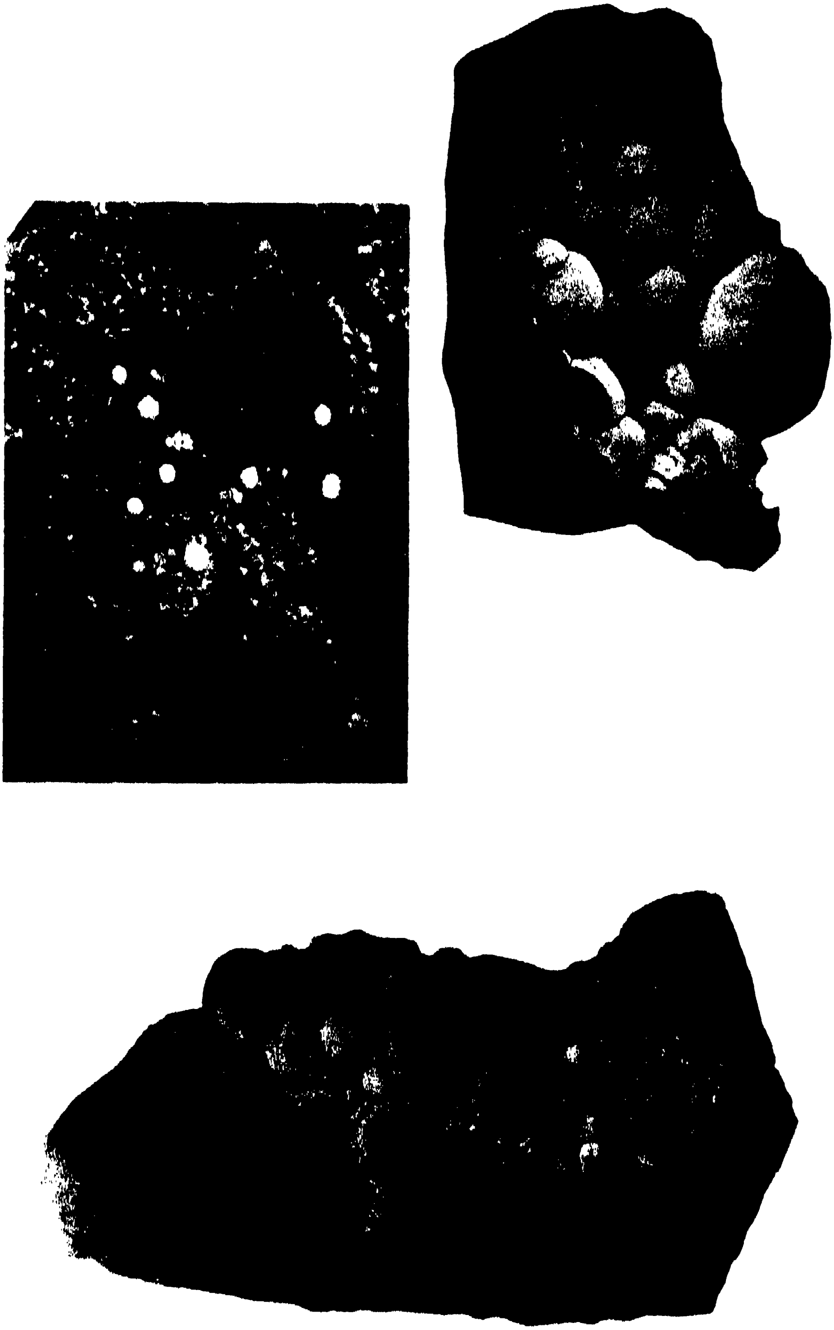
PLATE 3.

Upper: Thick coating of transparent colorless hyalite opal overlying small globules of first-generation siderite. *Lower:* Pseudomorph of limonite and goethite after large individual of second-generation siderite. Natural size.



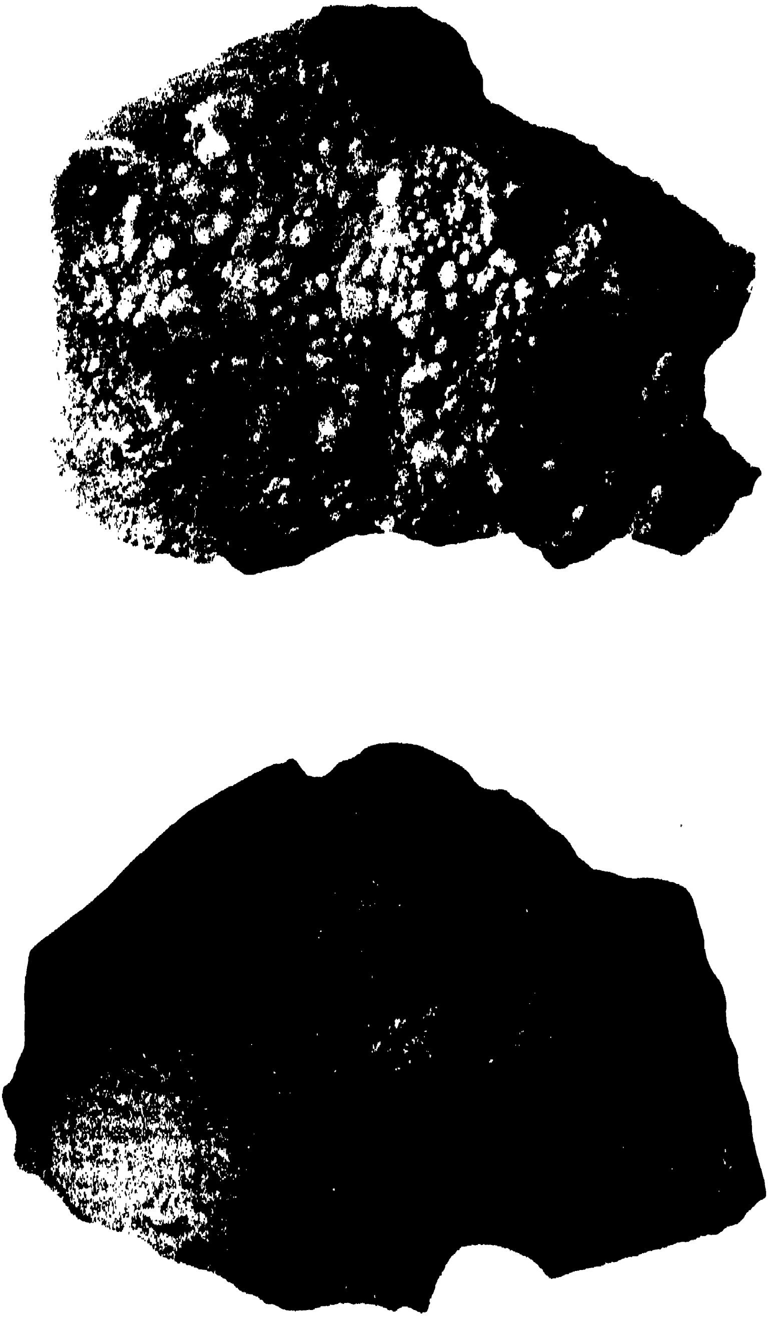
EXPOSURE OF COLUMBIA BASALT.

FOR EXPLANATION OF PLATE SEE PAGE 4.



CRISTOBALITE AND SIDERITE IN CAVITIES IN BASALT.

FOR EXPLANATION OF PLATE SEE PAGE 12



HYALITE, SIDERITE, AND GOETHITE IN BASALT.

FOR EXPLANATION OF PLATE SEE PAGE 15.

THE DERMANYSSID MITES OF NORTH AMERICA.

By H. E. Ewing,

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INTRODUCTION.

The Dermanyssid mites are here regarded as constituting a family, the Dermanyssidae, of the superfamily Gamasoidea.[1] They were so recognized, in a broader sense by Banks (1904), but later (1915) Banks reduced the group to the rank of a subfamily. His former decision in the matter will appear, the writer believes, amply justified when the unity of the group and its possibilities of division into various genera are considered.

The family Dermanyssidae is characterized as follows: Mouth parts adapted for piercing, the chelicerae being either devoid of one or both of the chelae or of all true teeth; but, however, recurved "holdfast" hooklike structures are sometimes present. Integument somewhat leathery and distensible, but covered to a large degree by one or more dorsal shields and one or more ventral plates. Each trachael trunk opening through a peritreme situated on the side of the body. Sexual dimorphism evident and at times marked. Parasitic in habits and on vertebrates.

Using the mouth parts as a basis, we can easily divide the family into four major groups, which are here given the rank of subfamilies. These subfamilies and their contained genera are separated as follows:

KEY TO THE SUBFAMILIES AND GENERA OF DERMANYSSIDAE.

a^1. Chelicerae adapted for both piercing and attachment, being provided with recurved barbs or hooks.

b^1. Both chelae of chelicera present, the fixed one harpoonlike with a single recurved barb and the movable one falciform; hypostome without recurved hooks.................... Subfamily **ENTONYSSINAE**, new subfamily.

Containing but one genus........................ **Entonyssus**, new genus.

b^2. One chela of chelicera lost, the remaining one provided with several recurved hooks; hypostome with a pair of recurved hooks.

Subfamily **IXODORYNCHINAE**, new subfamily.

Containing but a single genus............... **Ixodorhynchus**, new genus.

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[1] According to the rules of nomenclature it may be necessary to change the name of the type genus of this group to *Parasitus*. To do so, however, is most unfortunate not only because the name Gamasidae has been established by a century of usage but also because the name *Parasitus* is applied to free-living mites, hence is directly misleading in its meaning.

a^2. Chelicerae provided only for piercing, hence without hooks or barbs.
  b^1. Chelicerae shearlike in both sexes, never needlelike. Subfamily **LIPONYSSINAE**.
    c^1. Body of both sexes entirely covered above by dorsal shield, sternal plate of female large and reaching to the third coxae.. **Tetragonyssus**, new genus.
    c^2. Body not entirely covered above by dorsal shield in either sex.
      d^1. Female with a divided dorsal shield.
        e^1. Posterior dorsal shield large, covering much of abdomen above; first segment of palpus of female with a hornlike process. **Ceratonyssus**, new genus.
        e^2. Posterior shield minute; sternal plate with only four setae; first segment of palpus of female without any hornlike process. **Serpenticola**, new genus.
      d^2. Dorsal shield of female entire.
        e^1. Legs stout; tibia I and II less than one and a half times as long as broad; femora I and II spined above.............. **Ichoronyssus** Kolenati.
        e^2. Legs not so stout, especially the first and second pairs, tibiae I more than one and a half times as long as broad; femora I and II not spined above.
          f^1. Body of female with a constriction and incomplete transverse groove behind the insertion of the last pair of legs. **Leiognathus** Canestrini.
          f^2. Body of female without constriction and incomplete transverse groove. **Liponyssus** Kolenati.
  b^2. In the female, chelicerae needlelike; in the male, variously modified but always with both arms present........... Subfamily **DERMANYSSINAE**.
    c^1. Dorsal shield of female entire; anus situated in posterior part of anal plate. **Dermanyssus** Dugès.
    c^2. Dorsal shield of female divided; anus situated centrally in anal plate. **Allodermanyssus**, new genus.

One of the new subfamilies here created, the *Ixodorhynchinae*, is established for the new genus *Ixodorhynchus*, which contains a single species, also new. This species was taken some years ago in Iowa from the eyes of a snake and is quite remarkable. Its general characters are almost entirely those of the genus *Liponyssus*, *sensu lato*, yet the mouth parts are very much like those of some of the generalized ticks. The hypostome (fig. 3), while divided, is shaped for piercing and is provided with two powerful "holdfast" organs in the form of recurved hooks. The chelicerae are even more ticklike, being but little different from those of some of the true Ixodidae. They are short, stout, segmented at the middle, without one chela; and with the other, which is movable, provided with three powerful recurved hooks. In addition, two small tubercles are present at the base of the chela on the chelicera proper.

Some may doubt the justification of placing this species in the Dermanyssidae. True it is that the mouth parts are entirely different from those of the family Dermanyssidae as we have defined the family in the past. But if the species is not placed in this group the only other alternative is to create for it a new family. This latter course hardly appears justified at present in view of the fact that the number of families in the Acarina has been increased at an entirely too great a rate in recent years.

The other new subfamily created, the *Entonyssinae*, is established for the genus *Entonyssus*, with its single species, also new. This species was taken by Doctor M. C. Hall from the air sac of a snake. In *Entonyssus* each chelicera has one arm provided with a single hook (fig.1), but the hypostoma is without hooks.

GENERIC CHARACTERS IN DERMANYSSIDAE.

Recent workers have recognized but few genera in this family. The reasons for this are in part obvious. First, the genera proposed by the earlier workers, and more especially those proposed by Kolenati in 1859, were either based upon immature individuals or upon characters which could not be accepted as valid in the light of what is known about generic characters in related mite families. Second, but few of our recent mite specialists have had any considerable number of species to work with.

On account of this latter fact the present writer has been deterred for years in attempting any generic analysis of the group. Now, however, a sufficient amount of material is at hand to justify such an attempt. For the purposes of this analysis the genus concept will be defined as follows: A valid genus is a taxonomic category including either a unique species with one or more characters of a more fundamental nature than those used in specific diagnoses of the most nearly related species, or a category including a group of closely related species the majority of which possess at least two correlated characters of more than commonly recognized specific importance in the next larger group to which the genus belongs. The family Dermanyssidae does not lend itself so easily to generic anaylsis as the Gamasoidea as a whole does.

KOLENATI'S GENERA.

Kolenati (1859) was the first to make any extensive study of the group. In his Beiträge zur Kenntniss der Arachniden he not only proposes several new genera for the reception of his various species but divides the group into the following subgroups, for which English equivalent names are substituted: Fat mites, dirty mites, big mites, rough mites, broken-shield mites, and jointed-shield mites. Although written in a more or less popular manner, Kolenati's work is of high scientific value, and the species he describes are so well illustrated that no serious difficulty should be encountered in grasping their taxonomic value. The chief difficulty in passing on Kolenati's work is that he did not differentiate between the sexes or between nymphs and adults in his descriptions. Also in many instances one can not tell whether a drawing was made of a male or female or a nymph. This is not always true, however, for in some of his drawings it is easy to recognize whether a male, female, or nymph is represented. Kolenati's genera are here taken up according to their page preference.

Liponyssus.—This monobasic genus is the one most commonly used at present to include all the members of the family Dermanyssidae that have the chelicerae shearlike in both sexes. It has page preference over Kolenati's other genera, and for this reason some workers consider all the other genera of Kolenati as synonyms of this one. Kolenati gave three drawings of the type species of this genus, one being a dorsal view of an adult. The ventral view which he gives is either of a nymph or a female, probably the latter. The characters of the single, large, dorsal shield of the adult figured, together with what other characters that can be gleaned from Kolenati's description, are sufficient to show that this species belongs in the group having the broad shield with a broad, evenly rounded posterior border, and is nearly related to *Liponyssus corethroproctus* Oudemans.

Ichoronyssus, Kolenati's second genus, which included a number of species, was for a long time ignored. Recently (1915) Hirst gives this genus as being equal to *Leiognathus* Canestrini, a generic name which he had accepted previously as being practically equal to the *Liponyssus* Kolenati as interpreted by Banks and Oudemans. He adds, however, that *Ichoronyssus* Kolenati as he would use the genus is "probably not that of Kolenati." The species which Hirst places in *Ichoronyssus* Kolenati has two dorsal shields in the case of the female. All of the species figured by Kolenati under the generic name of *Ichoronyssus* have the dorsal shield entire. In fact, he specifically relegates those species with a divided dorsal shield to two of his other genera. The present writer believes that the genus *Ichoronyssus* Kolenati can be retained only by selecting with some care the proper genotype. One of the species included by Kolenati, *scutatus,* is sufficiently different and characteristic from the others to be used for a genus which should not be reduced to synonymy. Around this species as a type several of our more recently described species group themselves, and, luckily, all show a correlation of characters sufficiently important to be used as generic.

Macronyssus included two species, *longimanus* and *lepidopeltis.* Oudemans (1903) gives complete descriptions of nymph, male, and female of *lepidopeltis* together with many drawings. This species is not so very different from *Liponyssus lacertinus* (Berlese) and evidently belongs to the *setosus* group, for which *L. setosus* Kolenati stands as a monobasic type. The other species, *longimanus,* for which Kolenati gives a good drawing of a ventral view of a female and dorsal view of an adult, evidently belongs to the *setosus* group. Therefore, it appears that *Macronyssus* should fall into synonymy under *Liponyssus,* the latter genus having page preference.

Lepronyssus included several species, but the present writer can not at this time find any one of these that could stand as a type for a good genus. Since Kolenati's material was so widely distributed it would appear that in the future a study of this material would enable some one to preserve the genus. Any hasty selection of a type species in this genus would almost surely bury it permanently in synonymy.

Steatonyssus is evidently based largely on immature individuals, as both Kolenati's generic diagnosis and figures indicate. Of his four drawings two certainly are of nymphs and the remaining two probably of nymphs.

Pimelonyssus, the last of Kolenati's genera, is likewise based on characters of immature individuals.

DESCRIPTIONS OF GENERA HERE RECOGNIZED.

ENTONYSSUS, new genus.

Chelicerae with fixed arm harpoonlike, being sharply pointed and with a single, recured distal hook, and with the moveable arm falciform; hypostome without recurved hooks. Palpi moderate, filiform. Legs all similar and each tarsus provided with a pulvillus and two equal claws. The tarsal claws are very stout and strongly curved near their bases, but slender, straight, and sharply pointed distally.

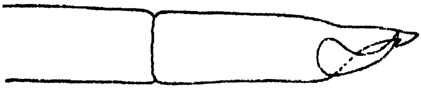


FIG. 1.—ENTONYSSUS HALLI, NEW SPECIES. VENTRO-INTERNAL VIEW OF CHELICERA.

Type species.—Entonyssus halli, new species.

The mouth parts in *Entonyssus* are so different from those of the other Dermanyssidae that a new subfamily should be created for it. This has been done, the subfamily Entonyssinae having been given in the key to genera.

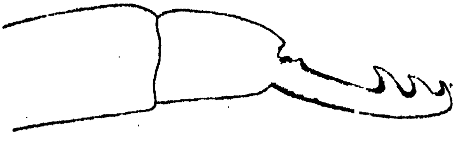


FIG. 2.—IXODORHYNCHUS LIPONYSSOIDES, NEW SPECIES. SIDE VIEW OF CHELICERA.

IXODORHYNCHUS, new genus.

Chelicerae each with but a single arm, which is provided with recurved hooks; hypostome large, divided and provided with a pair of recurved processes or hooks. Dorsal shield divided, the two parts completely covering the body above. Legs short, stout, spined.

Type species.—Ixodorhynchus liponyssoides, new species.

The relationships of this genus have already been discussed.

CERATONYSSUS, new genus.

Chelicera shearlike, being provided with both arms; hypostome without recurved hooks; basal segment of palpus of female with a hornlike process; dorsal shield of female divided, the posterior shield being large and about as long as the anterior.

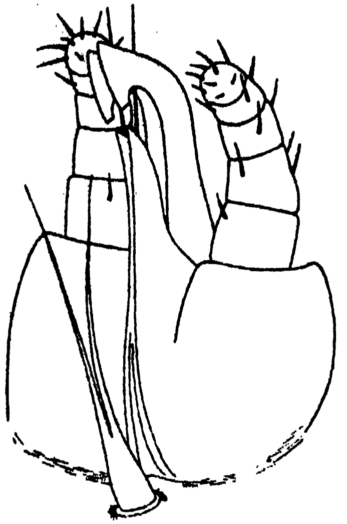


FIG. 3.—IXODORHYNCHUS LIPONYSSOIDES, NEW SPECIES. VENTROLATERAL VIEW OF MAXILLAE.

Type species.—Ceratonyssus musculi (C. L. Koch).

The employment of sexual characters for distinguishing genera has its objections, and under most conditions such characters should not be used. In the Gamasoidea, however, where the sexes are so different and where other characters than those of one sex only are hard to find, or for purposes of generic distinction do not exist, there is ample justification for the practice.

Besides the type, this genus includes *Liponyssus javensis* Oudemans and *Ceratonyssus ceratognathus*, new species, to be described in this paper.

SERPENTICOLA, new genus.

Chelicerae as in *Liponyssus*. Dorsal shield of female divided, the posterior shield being minute and subcircular; sternal plate of female with only four setae; basal segment of palpus in female without hornlike process; anal plate of female as in bird infesting *Liponyssus* species.

Type species.—Liponyssus serpentium (Hirst).

Only a single species included in this genus. It parasitizes American snakes.

TETRAGONYSSUS, new genus.

Chelicerae as in *Liponyssus*. Body large and in the type species squarish behind and with pronounced shoulders in front. Dorsal shield entire and completely covering the body in both sexes; legs stout, spined above; sternal plate of female large, reaching third coxae; ventral plate of male quadrangular in front.

Type species.—Liponyssus gigas Oudemans.

Besides the type two other species should probably be included in this genus, *L. spiniger* Ewing and Stover and *L. bermudaensis* Ewing.

Genus INCHORONYSSUS Kolenati.

Chelicerae as in *Liponyssus*. Body stout with shoulder regions well marked, abdomen not squarish behind; dorsal shield entire; legs stout, tibiae I and II never as much as one and a half times as long as broad, femur I and II spined above.

Type species.—Here designated as *Ichoronyssus scutatus* Kolenati.

Other species going in this genus are: *Liponyssus semitectus* (L. Koch); *L. spinosus* Oudemans; *L. arcuatus* (C. L. Koch); *L. carnifex* (C. L. Koch); *L. isabellinus* Oudemans; *L. albatus* (C. L. Koch) (Berlese). It also includes *L. sternalis*, new species, described in this paper.

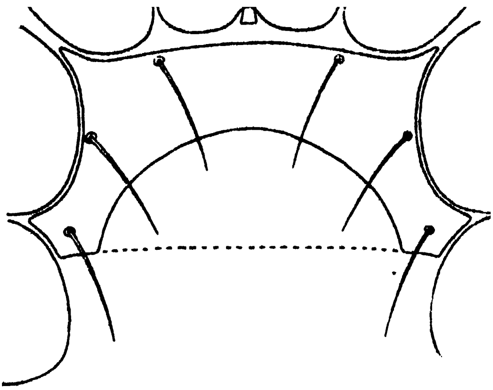


FIG. 4.—ICHORONYSSUS CARNIFEX (C. L. KOCH.) STERNAL PLATE OF FEMALE.

Genus LEIOGNATHUS Canestrini (s. st.).

Chelicerae as in *Liponyssus*. Body not entirely covered above by dorsal shield or shields in either sex; legs not very stout, tibia I always more than one and a half times as long as broad, femora I and II not usually spined above; in the case of the female the body is constricted suddenly and is provided with an incomplete transverse groove behind the insertion of the last pair of legs.

Type species.—*Leiognathus sylviarum* (Canestrini and Fanzago).

Besides the type, this genus, in its restricted sense, should include *Lyponyssus crosbyi* Ewing and *L. constrictus*, new species, which is described in this paper.

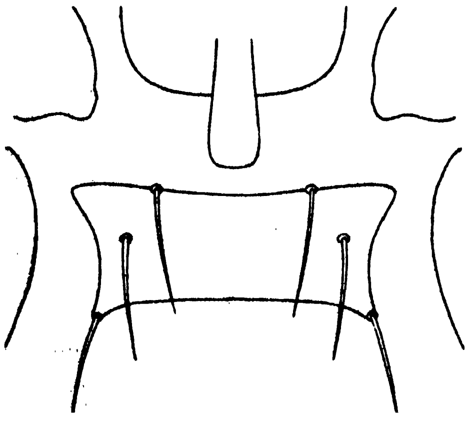


FIG. 5.—STERNAL PLATE AND STERNAL REGION OF A LIPONYSSUS SPECIES (L. BACOTI HIRST).

Genus LIPONYSSUS Kolenati.

Chelicerae with both arms present and shearlike. Body not entirely covered in either sex by dorsal shield; legs not very stout, tibia I more than one and one-half times as long as broad, femora I and II usually not spined above; body of female without constriction and incomplete groove behind insertion of last pair of legs.

Type species.—*Liponyssus setosus* Kolenati.

The genus *Ophionyssus* Mégnin (1884) should be considered as a synonym of *Liponyssus* as was pointed out by Berlese (1917).

The genus *Liponyssus* as here defined still includes most of its old species, among them being the following: *Lepronyssus fossulatus* Kolenati; *Liponyssus corethroproctus* Oudemans; *Macronyssus longimanus* Kolenati; *Liponyssus uncinatus* (Canestrini); *L. americanus* Banks; *L. canadensis* Banks; *L. bursa* (Berlese); *L. bacoti* (Hirst); *Ichoronyssus decussatus* Kolenati; *L. lepidopeltis* (Kolenati); *L. lacertinus* (Berlese); and *L. natricia* (Gervais). Also the following new species here to be described go in this genus: *L. tenuiscutatus*, *L. pacificus*, and *L. montanus*.

Genus DERMANYSSUS Dugès.

In the female the chelicerae are long and needlelike, being composed of two closely adhering elements, which probably represent the two arms of *Liponyssus*. In the male the chelicerae are not needlelike, but are variously formed, both arms being always present and easily recognized. Dorsal shield large and undivided in both sexes; legs rather slender, especially the front pair. Rim of anus greatly thickened behind, and the anus itself usually situated in the posterior half of anal plate.

Type species.—*Dermanyssus gallinae* (Redi).

In 1913 Hirst proposed *Liponyssoides* as a new subgenus for a rat-infesting species. He stated that the capitulum was differently shaped from that of *Dermanyssus* and that the male chelicera was provided with a flagellum bearing a small tooth. It is to be questioned if the type of chelicera described by Hirst is really different fundamentally from that of the male of *D. gallinae*. Therefore, it appears best to leave *Dermanyssoides* as a subgenus, denying it generic rank.

ALLODERMANYSSUS, new genus.

Mouth parts similar to those of *Dermanyssus*. Dorsal shield in female divided into two plates, the posterior one being minute; in the male, dorsal shield attenuated posteriorly. Sternal plate squarish and with six setae. Anal plate egg shape in outline and with anus situated centrally. Legs as in *Dermanyssus*.

Type species.—*Dermanyssus sanguineus* Hirst.

This genus is amply distinct from *Dermanyssus*, showing in the formation of the dorsal shield, the sternal plate, and anal plate a correlation of three fundamental characters.

DESCRIPTIONS OF NORTH AMERICAN SPECIES.

Genus ENTONYSSUS Ewing.

ENTONYSSUS HALLI, new species.

Female.—A medium-sized, light-brownish gamasoid. Palpi moderate, of generalized type, a few minute spinelike setae at tip, the one on the inside being the largest; chelicerae moderate, fixed arm harpoonlike, with a sharp point and a distal, backwardly directed barb, movable arm not extending to the tip of fixed arm and shaped like the claw of a hawk. Dorsal shield large and undivided. Stigmata situated ventrolaterally above and behind the third coxae. Sternal plate large and reaching to the posterior margin of third coxae. Anal plate large and extending to the posterior margin of abdomen. Legs similar in shape, the posterior pair being the longest; tarsus of leg I about twice as long as tibia; claws of all the legs stout and strongly curved at their base but with their distal part tapering to a fine sharp point. Length, 0.69 mm.; width, 0.41 mm.

Male.—Unknown.

Type locality.—(?)

Holotype.—Cat. No. 24743, U.S.N.M.

Described from holotype specimen taken from air sac of Pine snake at National Zoological Park by Dr. M. C. Hall on October 14, 1908. Two or three other specimens were taken, but these were practically destroyed in the process of preparation. One of them is on slide with type.

Genus IXODORHYNCHUS Ewing.

IXODORHYNCHUS LIPONYSSOIDES, new species.

A stout brownish species, with the sides of the body about parallel. Palpi moderate, filiform. Chelicerae not large but heavily chitinized, three recurved hooks present, the proximal being the largest and the distal smallest, arm of chelicera longer than the distal segment from which is springs. Dorsal shield entirely covering the body and divided by a transverse suture into two subequal parts. Peritreme long, sinuous, and extending beyond the anterior coxae. Sternal plate large, reaching third coxae. Anal plate oval, with anus situated centrally. Legs short, stout, subequal; tarsus of leg I about one and a half times as long as the tibia, the latter being almost as broad as long; patella of leg I with four long, stout spines above; femur with two similar but even larger spines. Length, 0.63 mm.; width, 0.44 mm.

Type locality.—Madrid, Iowa.

Type slide.—Cat. No. 24744, U.S.N.M.

Described from various cotypes mounted on five different slides. All specimens collected by M. F. Boyd from eye of snake at Madrid, Iowa. On two of the five slides in the United States National Museum are the mouth parts dissected so as to show their nature to a better advantage.

Genus TETRAGONYSSUS Ewing.

KEY TO NORTH AMERICAN SPECIES.

a^1. Species larger and much more heavily spined; at least one pair of spines on femur I almost half as long as front legs; and plate fully twice as long as broad, anus with an even but enormously thickened rim, anal setae minute.
T. spiniger (Ewing and Stover).

a^2. Species smaller and much less heavily spined; longest spine of femur I less than one-third the length of leg I; anal plate subtriangular and about as broad as long, anus with an uneven and but moderately thickened rim, anal setae large spines which almost reach the tip of anal plate... **T. bermudaensis** (Ewing).

TETRAGONYSSUS SPINIGER (Ewing and Stover).

Female.—Large and spiny. Palpus and chelicera rather small; one of the arms of the latter longer than the other. Above the body is sparsely clothed with short spines, those toward the front being recurved and along each side there is a row of longer spines. Peritreme very sinuous and extending to opposite the anterior coxae. Sternal plate very large, longer than broad, and reaching the fourth coxae. Anal plate twice as long as broad, and broadly rounded in front; anus oval in outline, rim almost as broad as anal aperture and of even thickness; anus itself situated almost entirely in front of the middle transverse line; paired setae, minute, situated on rim of anus; median seta large and situated on a low tubercle at base of caudal area, the latter being triangular and scobinate. Legs stout, especially the first two pairs; dorsal spines of femur I two in number, the outer situated on a tubercle and enormous, being half again as long as the inner. Length, 0.78 mm.; width, 0.51 mm.

Male.—Considerably smaller than the female. Dorsal shield large but short, broadly rounded behind and not extending beyond the middle of abdomen, sides convex. Holoventral plate very much produced between the second and third coxae and expanded on the abdomen, with the following spinelike setae: A pair on either side of genital opening; a pair opposite second coxae and another opposite third coxae; a pair situated on a level between the third and fourth coxae and six pairs on abdominal part of plate. Genital opening somewhat funnel shaped with well-developed rim. Anus almost circular, situated about twice its greatest diameter from the posterior margin of holoventral plate. Length, 0.65 mm.; width, 0.38 mm.

Type locality.—Ithaca, New York.

Type.—A single female, the uppermost specimen on type slide, is here designated as type.

The description here given is based on specimens on type slide, which were taken from muskrat. Other records are: Many specimens from muskrat, Florence, Montana, March 27, 1910, Dallas acc. 2437; one specimen from muskrat, Cambridge, Maryland, March 16, 1909, by N. Hollister; six specimens from muskrat, Amherst, Massachusetts, February 16, 1908, by C. W. Hooker.

TETRAGONYSSUS BERMUDAENSIS (Ewing).

Female.—Body and appendages uniform light yellowish brown. Palpi long. Body sparsely clothed above with moderate setae; around the lateral margins is a row of setae which are scarcely as long as some of those on the dorsum. Peritreme S-shaped and extending to about the middle of second coxae. Sternal plate about as broad as long, reaching the third coxae; anterior setae situated on anterior margin; middle setae situated on lateral margins and posterior setae at the posterolateral corners; all sternal setae very long and subequal. Anal plate somewhat triangular in shape; anus squarish in front and rounded behind, and situated almost centrally; paired setae spinelike and situated near the posterior margin of anus; median seta almost enormous and situated at the base of caudal area, the latter being crescentic and scobinate. Femur of leg I with three dorsal setae, the outer being the longest and the posterior the shortest. Length, 0.65 mm.; width, 0.46 mm.

Male.—Not known.

Type locality.—Bermuda.

Type.—A single female, the only one mounted with dorsal side upward on type slide, is here designated as type.

Description based on individuals on type slide, all of which were taken from wood rat, Bermuda, July 9, 1910, by A. O. Gross.

Genus CERATONYSSUS Ewing.

CERATONYSSUS CERATOGNATHUS, new species.

Female.—A medium-sized species. Palpi reaching slightly beyond first femora; chelicerae with two arms equal and hooked at their tips. Dorsal shield divided; posterior shield about as long as anterior, truncate in front, sides convex, and extending almost to the posterior margin of abdomen. Peritreme sinuous, extending to about the middle of second coxa. Sternal plate fully twice as broad as long; anterior setae situated on the anterior margin; middle setae situated just inside of lateral margins and nearer to posterior than anterior setae; posterior setae situated on angular corner extensions; all sternal setae long and subequal. Anal plate heart-shaped, with the anus situated entirely in the anterior half; paired setae situated near rim of anus; median seta subequal to paired setae and situated about its length behind the anus; caudal area large, not crescent-shaped, and provided with longitudinal roughened ridges. Anterior legs longer than the second legs, which are slightly the stoutest. Length, 0.65 mm.; width, 0.39 mm.

Male.—Smaller than the female. Palpi without the conspicuous inner horn of basal segment found in the female; chelicerae about as in female. Dorsal shield large and entire, covering most of the body and reaching almost to the tip of abdomen, broadest at the shoulders and with lateral margins convex behind the shoulders. Holoventral plate broadest at its angular expansions between the second and third coxae, not laterally expanded on the ventral surface of abdomen; genital duct chitinized for a considerable distance behind the genital opening; genital opening with well-developed rim; genital setae situated about halfway between the genital opening and lateral margins of plate. Anus with longitudinal diameter about twice as great as transverse, and situated about two and one-half times its greatest diameter in front of posterior margin of holoventral plate. Length, 0.61 mm.; width, 0.35 mm.

Type locality.—Batesburg, South Carolina.

Type slide.—Cat. No. 24745, U.S.N.M.

Described from several cotypes mounted on two slides. Specimens on one slide taken from a small bat (*N. humeralis*), July 3, 1912, and on other slide from a bat, May 20, 1914. Both lots from type locality by E. A. McGregor.

Genus SERPENTICOLA Ewing.

SERPENTICOLA SERPENTIUM (Hirst).

Female.—A medium-sized, rather long and hairy species. Palpi about reaching the tips of anterior femora. Two dorsal shields, the anterior shield covering most of the cephalothorax and being almost circular, while the posterior shield is minute. It is also almost circular and is situated directly above the anal plate. Peritreme slightly curved and not quite reaching the middle of second coxa. Sternal plate fully twice as broad as long and lying entirely between the second coxae; anterior setae situated slightly behind the anterior margin but posterior setae situated directly on the lateral margins. Anal plate pear-shaped in outline, anus with longitudinal diameter much the greater, rim heavily chitinized. The anus itself is situated entirely in front of the middle transverse line; paired setae situated about halfway between rim of anus and lateral margins of anal plate; median seta situated a little over its length from the posterior margin of anal plate. Anterior legs considerably longer than second pair. Length, 0.79 mm.; width, 0.39 mm.

Male.—Unknown.

Type locality.—Species originally described from specimens obtained in London zoological gardens.

Type.—The location of the type is unknown to the author.

This description based on three females, one from snake, Atlanta, Georgia; and two from snake, New York City. Collector (?) Clifford Pope.

Genus ICHORONYSSUS Kolenati.

KEY TO NORTH AMERICAN SPECIES.

a^1. Dorsal shield about as broad as long.................. **I. semitectus** (L. Koch).
a^2. Dorsal plate scarcely half as broad as long.
  b^1. Dorsal shield of female with lateral margins concave.
    c^1. Sternal plate of female about two-thirds as long as broad and posterior margin but slightly arched; coxae without posterior spines.
      I. sternalis, new species.
    c^2. Sternal plate of female scarcely one-half as long as broad; coxae II, III, and IV with large posterior spines.................. **I. carnifex** (C. L. Koch).
  b^2. Dorsal shield of female with lateral margins decidedly convex.
    I. isabellinus (Oudemans).

ICHORONYSSUS SEMITECTUS (L. Koch).

Trägårdh in his Monographie der arktischen Acariden gives a record of this species from Greenland. A brief diagnosis of the female is here given, data being obtained chiefly from Trägårdh's figures.

Female.—Dorsal shield covering the cephalothorax completely for most of its length and reaching somewhat beyond the middle of the abdomen; it is almost as broad as long. Peritreme curved but not sinuous and reaching to about the anterior margin of front coxae. Sternal plate about as broad as long and broadly excavated on the sides near the second coxae. Anal plate somewhat triangular; anus in front of middle transverse line; anal or paired setae small; median setae a long spine reaching for half its length beyond the tip of abdomen.

Greenland specimens from *Myodes torquatus.* Other records for this species come from Siberia and Novaja Zemlya.

ICHORONYSSUS STERNALIS, new species.

Female.—Mounted specimen red (probably due to engorgement). Dorsal shield entire and covering most of the body, evenly rounded behind. Peritreme sinuous and extending well in front of the second coxae. Sternal plate broader than long and barely reaching the third coxae; sternal setae subequal; anterior pair situated just behind the anterior margin; middle pair situated inside lateral margins and in a direct line between the anterior and posterior setae; posterior setae situated at the middle of angular processes. Anal plate broadyl rounded in front and pointed behind; anus slightly oval in outline and situated entirely in front of middle transverse line; paired setae very long and situated about one-half the distance from the rim of the anus to the lateral margins; median seta very long and situated about one-half its length from the tip of anal plate. Length, 0.81 mm.; width, 0.45 mm.

Male.—Unknown.

Type locality.—Plummer Island, Maryland.

Type.—Cat. No. 24746, U.S.N.M.

Described from a single female the only specimen present in the U.S.N.M. collection. It was taken from a woodchuck, May 19, 1912, by H. S. Barber.

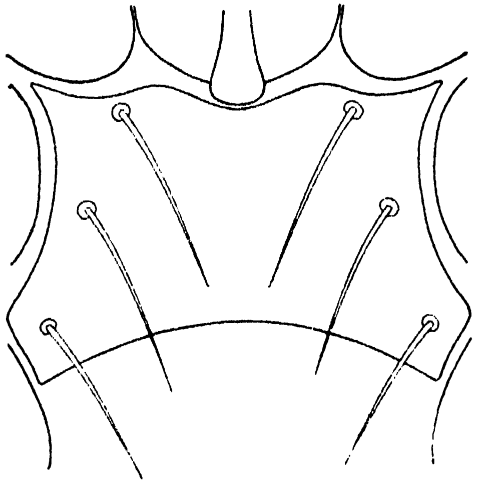


FIG. 6.—ICHORONYSSUS STERNALIS, NEW SPECIES. STERNAL PLATE.

ICHORONYSSUS CARNIFEX (C. L. Koch).

Female.—Stout and sparsely clothed with minute setae. Dorsal shield large, not entirely covering the cephalothorax, lateral margins behind the shoulders concave. Peritreme very long and sinuous, extending slightly beyond the first coxae. Sternal plate archlike, having the posterior margin deeply crescentic, reaching the third coxae; anterior setae situated almost on the anterior margin; middle setae situated almost on lateral margins but outside of line from anterior to posterior setae; posterior setae situated at about equal distances from inner, outer, and posterior margins of corner projections of sternal plate; all sternal setae long and subequal. Anal plate somewhat heart-shaped; anus oval in outline and situated entirely in front of middle transverse line; anal area large and extending almost to base of median seta. Legs stout, especially first two pairs; femur of leg I with two conspicuous spines above, the inner being the longest. Length, 0.60 mm.; width, 0.36 mm.

Male.—The writer has never seen a male of this species, but Oudemans has given a very complete description of it, and a group of eight drawings. The following diagnosis is made from Oudemans's drawings: Dorsal shield very large, covering most of the body above and extending almost to the tip of abdomen, broadest at the shoulders, slightly convex on the sides, and broadly rounded behind. Holoventral plate broadest at its angular extensions between the second and third coxae, and expanded on the abdomen; setae as follows: A pair just behind anterior margin; another opposite second coxae; a third and fourth pair opposite third coxae; four pairs on broadened abdominal part of plate; an anal pair and a posterior median seta. Anus situated its greatest diameter in front of posterior margin of holoventral plate. Length, 0.44 mm.; width, 0.26 mm.

Type locality.—(?) Germany.

Type.—The location of the type is unknown to the author.

This description is based on a specimen from the house mouse, taken at Corvallis, Oregon, January 9, 1912, by the writer. I can find no other record of the occurrence of this species in North America. Exotic records are from *Talpa*, *Mus*, *Vespertilio*, *Arvicola*, and *Pterygistes*.

ICHORONYSSUS ISABELLINUS (Oudemans).

Female.—Body sparsely clothed with moderate setae. Dorsal shield covering all the body above except a narrow margin on the sides. Peritreme sinuous and extending as far as the anterior margin of the front coxae. Sternal plate archlike and continued between first and second coxae as cusps; anterior setae situated almost on the anterior margin; middle setae situated almost on the lateral margins; posterior setae situated near tip of produced posterior angles; all sternal setae long, slender, and subequal. Anal plate broadly rounded in front; anus almost circular, with rim somewhat thickened behind, and situated entirely in front of the middle transverse line; paired setae situated about halfway between the margin of anus and lateral margins of anal plate; anal area scobinate and extending about halfway to base of median seta. Longest dorsal spine of femur I about equal in length to width of this segment. Length, 0.66 mm.; width, 0.32 mm.

Male.—The writer has never seen a male of this species. The following synopsis of characters is made from six good figures by Oudemans: Dorsal plate covering almost all of the upper surface of the body, sides almost straight, posterior margin rounded and at the tip of abdomen. Holoventral plate angularly produced between first and second coxae and second and third coxae, but not between third and fourth coxae, expanded slightly on the abdomen. All of the setae on the holoventral plate except the posterior median seta are arranged into two lateral irregular rows, there being four pairs on the sternal region and four on the abdominal region exclusive of the anal setae. Anus situated about twice its greatest diameter from the posterior margin of holoventral plate. Length, 0.50 mm.; width, 0.34 mm.

Type locality.—Holland.

Type.—The location of the type is unknown to the author.

North American records as follows: From mouse, Washington, District of Columbia; from mole, Corvallis, Oregon, June 3, 1912, by the writer. Exotic hosts of this species: *Putorius, Paludicola,* and *Mus.*

Genus LEIOGNATHUS Canestrini.

KEY TO NORTH AMERICAN SPECIES.

a^1. Dorsal shield of female about as broad near the middle of the abdomen as at the shoulders; anal plate somewhat triangular, with pointed caudal area. **L. crosbyi** (Ewing).

a^2. Dorsal shield of female only about one-half as broad near the middle of abdomen as at shoulders; anal plate of female not at all triangular and with caudal area broadly rounded behind.................. **L. constrictus**, new species.

LEIOGNATHUS CROSBYI (Ewing).

Female—Stout, with body clothed above with short setae. Palpi long, reaching to about the middle of anterior tibiae. Dorsal shield about as broad near the middle of the abdomen as at the shoulders and broadly rounded behind. Peritreme quite sinuous and extending to the front margin of anterior coxae. Sternal plate slightly broader than long; reaching the third coxae and anterior corners produced into cusps; anterior setae situated just behind the anterior margin; middle setae situated away from lateral margins but outside a line from anterior to posterior seta; posterior setae situated nearer lateral than posterior margin; all sternal setae long, slender, and subequal. Anal plate with broadly rounded anterior margin and almost straight sides; anus with longitudinal diameter greater than transverse; anal area minute; setae of anal plate about straight and subequal. Legs short and stout. Length, 0.60 mm.; width, 0.38 mm.

Male.—Unknown.

Type locality.—Rockport, Missouri.

Type.—Type (holotype) established at time of original description, and at present in the writer's collection. A single record from a bat (*Vesper subulatus*), type locality, by C. R. Crosby.

LEIOGNATHUS CONSTRICTUS, new species.

Female.—Stout, with the body constriction rather pronounced. Palpi long, reaching to the tibia. Dorsal plate only about one-half as broad near the middle of abdomen as at shoulders. Peritreme very sinuous and extending to opposite the anterior coxae. Sternal plate about as broad as long. Anal plate twice as long as broad; anus with longitudinal diameter greater than transverse, its rim poorly chitinized and very thin behind; paired setae situated about halfway between rim of anus and lateral margins; median seta situated slightly more than its length behind rim of anus, and subequal to paired setae; anal area extending halfway to base of median seta, scobinate. Legs of medium length; anterior pair longer than second pair; tarsus I about twice as long as tibia I; third legs apparently the shortest. Length, 0.60 mm.; width, 0.38 mm.

Male.—Unknown.

Type locality.—Rochester, New York.

Holotype.—Cat. No. 24747, U.S.N.M. A large female, mounted ventral side up near the top of slide selected, only one other large female on type slide.

Seven specimens from wood thrush, type locality, by G. A. Franck.

Genus LIPONYSSUS Kolenati.

KEY TO NORTH AMERICAN SPECIES.

- a^1. Anal plate of female triangular, or almost so; paired setae, or anal setae, situated on a transverse line drawn at the posterior rim of anus; anal rim very thick. **L. triangulus**, new species.
- a^2. Anal plate of female in no way triangular; paired setae situated in front of a transverse line drawn at the posterior rim of anus; anal rim not so thick.
  - b^1. Anus situated less than one-half its greatest diameter from the front margin of anal plate.
    - c^1. Rim of anus of uniform thickness and anal setae situated but slightly in front of posterior margin of anus........................... **L. bacoti** (Hirst).
    - c^2. Rim of anus thicker in front and behind than on the sides, anal setae situated considerably in front of the posterior margin of anus. **L. pacificus**, new species.
  - b^2. Anus situated over two-thirds its greatest diameter from the front margin of anal plate.
    - c^1. At the middle of dorsum of abdomen dorsal shield of female is over one-half as broad as body.
      - d^1. Sides of dorsal shield of female converging rapidly on the abdomen and tip of same about over anus.
        - e^1. Dorsal shield of female never more than about three-fourths the width of the cephalothorax.......................... **L. americanus** Banks.
        - e^2. Dorsal shield of female practically covering the cephalothorax to behind the insertion of second legs........... **L. occidentalis**, new species.
      - d^2. Sides of dorsal shield not converging rapidly, and in both sexes the same covers most ol the body dorsally............... **L. canadensis** Banks.
    - c^2. At the middle of dorsum of abdomen dorsal shield of female less than one-half as broad as body.
      - d^1. Anal plate broadly and evenly rounded in front; anal setae situated at the level of the anterior margin of anus........ **L. montanus**, new species.
      - d^2. Anal plate somewhat pointed in front and not at all evenly rounded; anal setae situated much behind the level of the anterior margin of anus.
        - e^1. At its broadest place dorsal shield of female not over one-half as broad as cephalothorax....................... **L. tenuiscutatus**, new species.
        - e^2. At its broadest place dorsal shield of female at least two-thirds as broad as cephalothorax............................. **L. bursa** (Berlese).

LIPONYSSUS TRIANGULUS, new species.

Female.—Medium sized and stout. Palpi reaching the tips of anterior patellae; chelicerae stout, well chitinized. Dorsal shield broad, at its widest place over three-fifths as wide as cephalothorax. Peritreme long, slightly sinuous and extending to opposite the anterior coxae. Sternal plate about as long as broad and reaching the third coxae; anterior setae situated just behind the anterior margin; middle setae situated on a line between anterior and posterior setae; the latter situated at an equal distance from lateral and posterior margins. Anal plate triangular (hence name *triangulus*); and with greatest diameter longitudinally, rim uniform and very thick; paired setae situated near rim of anus at the posterior margin; caudal area extending almost to base of median seta. Legs stout; coxal rings I and II, each with chitinous tubercle on inside. Length, 0.63 mm.; width, 0.41 mm.

Male.—Unknown.

Type locality.—Maryland.

Type (cotypes).—Cat. No. 24753, U.S.N.M.

Described from seven individuals taken from King snake, *Lampropeltis calligaster*, U.S.N.M. No. 61726.

LIPONYSSUS BACOTI (Hirst).

Female.—Palpi slender, reaching to about the tips of first femora; chelicerae very slender and fitted for piercing chiefly, the cutting surfaces being poorly developed. Dorsal shield reduced, at its broadest place about one-half as broad as the cephalothorax, behind the shoulders the lateral margins are wavy. Peritreme long, slightly sinuous, and extending almost to the anterior margin of coxa I. Sternal plate extending entirely between the second coxae, its anterior margin almost straight; front setae situated directly on the anterior margin; middle setae situated between front and rear setae, the latter being at the apex of posterior angles. Anal plate broadly and evenly rounded in front; anus front of middle transverse line, rim uniform; paired setae situated at the level of the posterior margin of anus; median seta situated almost twice its length behind the anus; caudal area reduced, crescentic and scobinate. Length, 0.78 mm.; width, 0.56 mm.

Male.—Notwithstanding a large number of slides of this species are in the United States National Museum, no male is present. The following facts relative to the male are gleaned from Hirst's description: Dorsal shield, "almost as wide and long as the body, but leaving a narrow lateral strip of unprotected integument (except anteriorly)." The "sternal plate" (holoventral plate) is described as follows: "Long, narrow, and furnished with eight or nine pairs of long hairs and the usual unpaired posterior hair; it is slightly narrowed before the anal portion." Hirst gives the length of the body of the male as 0.43 mm.

Type locality.—Assiût, Egypt.

Type.—Not established. *Type host.*—*Mus norvegicus.*

North American records as follows: On mice, New York City, December 30, 1919; on mouse, St. Louis, Missouri, from Dr. L. Loeb; from young mouse, H. L. Osborn; on heads of children and on mice, Laredo, Texas, through Public Health Service, 1921; from walls of railroad station, Longwood, Mississippi, April 12, 1921 (Mound No. 1034), also specimens from same locality by Dr. Van Dine (Mound No. 1031); biting men working in basement, Fort Worth, Texas, April 21, 1921; annoying man, Dallas, Texas, May 25, 1921 (Bishopp No. 10062); in hair of house mouse, Washington, District of Columbia, by Dr. E. Francis, July 1921. Exotic records are from Egypt, Abyssinia. Australia, and Argentina.

LIPONYSSUS PACIFICUS, new species.

Female.—Palpi extending to the tips of femora of front legs. Chelicerae slender; arms slender and slightly unequal, the outer being a little longer and hooked at the tip. Dorsal shield almost reaching across the cephalothorax at the shoulders, lateral margins slightly convex behind the shoulders. Sternal plate twice as broad as long and extending only between the second coxae; posterior angles produced into long cusps; anterior setae directly upon the anterior margin of sternal plate; all sternal setae subequal and in a row. Anal plate broadly rounded in front; anus with greatest diameter longitudinally, rim thicker in front and behind; anus situated entirely in front of a middle transverse line; anterior setae situated slightly behind the level of the central point of anus; median seta extending beyond the tip of plate; caudal area extending to over halfway to the base of median seta. Legs moderate. Length, 0.57 mm.; width 0.32 mm.

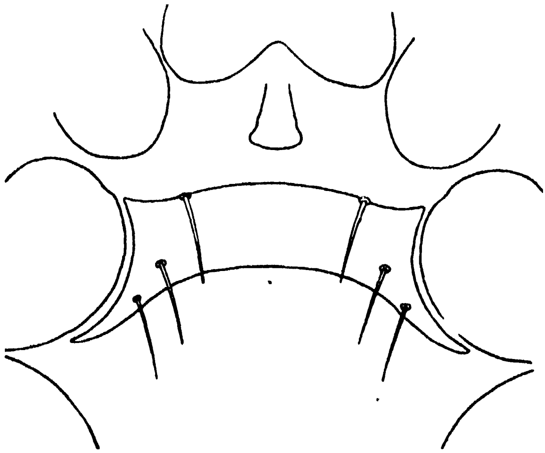


FIG. 7. LIPONYSSUS PACIFICUS, NEW SPECIES. STERNAL PLATE.

Male.—Unknown.

Type locality.—Corvallis, Oregon.

Type (cotypes).—Cat. No. 24752, U.S.N.M.

Many specimens from nest of brewer's blackbird, by A. J. Stover.

LIPONYSSUS AMERICANUS Banks.

Female.—Palpi moderate; chelicerae slender, each with two slender arms. Dorsal shield large, broadest over the bases of third legs; lateral margin behind the shoulders convex. Peritreme sinuous, extending to opposite the first coxae. Sternal plate over twice as broad as long and extending entirely between the second coxae; anterior setae situated directly upon the anterior margin; middle setae situated inside of lateral margins and almost directly between the first and last setae; last setae situated nearer the lateral margins than the middle setae; all sternal setae of moderate length, slender and subequal. Anal plate rounded in front and about twice as long as broad; anus almost circular and with uniform rim; paired setae halfway between rim and lateral margin; median seta situated about its length behind anus; caudal area small and crescentic. Legs moderate. Length, 0.55 mm.; width, 0.39 mm.

Male.—In Banks's orignal description the sex of the individuals described is not mentioned. The description itself, however, shows that females were at hand. On the type slide (marked holotype) are six individuals, all females. The male of this species, therefore, appears to be unknown.

Type locality.—Washington, District of Columbia.

Type.—A single female, the specimen situated by itself at the top of type slide, is here selected as type. Taken from arm of person, Washington, District of Columbia; on yellow-bellied sapsucker, Raleigh, North Carolina, March 23,1895, by H. H. and C. S. Brimley.

LIPONYSSUS OCCIDENTALIS, new species.

Female.—Small, with a large dorsal shield. Palpi moderate; chelicerae stout. Dorsal shield extending across the body at the shoulders, lateral margins behind the shoulders convex. Peritreme very long and very sinuous, reaching the anterior coxae. Sternal plate about three times as broad as long, barely reaching the third coxae and with posterior margin strongly arched; anterior setae situated on anterior margin; middle setae situated on a line between the anterior and posterior setae; the latter almost at the tip of posterior angles. Anal plate egg-shaped in outline; anus small, almost circular, with uniform rim and situated in front of a middle transverse line; paired setae situated near the level of the anterior margin of anus; posterior setae situated more than its length behind anus; caudal area forming a lobelike projection of anal plate. Legs moderate. Length, 0.61 mm.; width, 0.31 mm.

Male.—Unknown.

Type locality.—Montana.

Type (holotype).—Cat. No. 24749, U.S.N.M. Type specimen the one of two contained females, which is mounted dorsal side up, with specimens of *L. montanus* on type slide. One record: "On *S. h. richardsoni*, King coll., Dallas acc. 2467."

LIPONYSSUS CANADENSIS Banks.

Female.—Medium-sized. Palpi reaching to about the tips of femora; chelicerae very slender and each arm slightly hooked at the tip. Dorsal shield large, sides irregularly convex, and not broadly and evenly rounded behind. Peritreme long and sinuous and extending to opposite the first coxae. Sternal plate over twice as broad as long and reaching only between the second coxae; anterior setae situated slightly behind anterior margin; middle setae situated almost on the lateral margins; posterior setae situated at apex of projecting posterior corners. Anal plate broadly and evenly rounded in front; anus almost circular and with thin, uniform rim; paired setae situated opposite middle of anus; median seta situated its length from the anus; caudal area rather small, crescentic and scobinate. Legs moderate; posterior pair extending beyond tip of abdomen. Length, 0.52 mm.; width, 0.28 mm.

Male.—The writer has never observed the male of this species. According to Banks, the body of the male is nearly twice as long as broad. This is the only statement relative to the male characters in his description. It might be inferred, therefore, that the two sexes are much alike except for those characters that are commonly recognized in the sexual dimorphism found in the family.

Type locality.—Guelph, Ontario.

Type.—No published selection of type.

This description based on two United States National Museum lots; one consisting of 13 specimens taken from a chicken, at Framingham Center, Massachusetts; the other of 13 specimens taken from nest of purple grackle, Long Bridge, Alexandria County, Virginia, by Shannon. Other North American records are, on English sparrow, red-eyed vireo, meadow lark, and kingbird, Guelph, Ontario.

LIPONYSSUS MONTANUS, new species.

Female.—Large, and similar to females of *Haemogamasus*. Palpi large; chelicerae shearlike but the hooked tips of both arms rather blunt and suggesting the toothed arms of *Haemogamasus*. Dorsal shield medium, lateral margins behind shoulders very slightly convex. Peritreme long, sinuous, and extending to opposite coxae I. Sternal plate of female with posterior corners broadly rounded and not extended. Anal plate very large, broadly rounded in front and somewhat truncate behind; anus subcircular, with uniform rim and situated almost centrally; paired setae situated far forward, being at the level of the anterior margin of the anus; median seta situated about its length behind the anus; caudal area crescentic, scobinate. Legs long; anterior pair longer than the second pair and about equal to the last pair; last pair reaching to about the tip of the abdomen. Length, 1.02 mm.; width, 0.61 mm.

Male.—Unknown.

Type locality.—Florence, Montana.

Type (*holotype*).—Cat. No. 24751, U.S.N.M. On type slide are three females, one replete and two only slightly engorged. Only one of the latter is mounted ventral side up, and it is selected as type. On "*S. h. richardsoni,*" at Florence and Derby, Montana (Dallas accs. 2452 and 2294).

LIPONYSSUS TENUISCUTATUS, new species.

Female.—Palpi rather large, reaching tips of patellae; chelicerae slender. Dorsal shield very long, extending from base of beak to tip of abdomen, greatest width less than one-half that of body, margins behind the shoulders slightly convex. Peritreme long, sinuous, and extending to opposite the first coxae. Sternal plate broader than long. Anal plate very long and somewhat pointed in front; anus oblong, rim uniform; paired setae long, equal to longitudinal diameter of anus and situated opposite the middle of same; median seta longer, slightly, than the paired setae and situated about its length behind the anus; caudal area extending halfway from tip of plate to base of median seta. Legs moderate; leg I longer than leg II, and with tibia about one and three-fourths as long as wide; last pair of legs scarcely reaching the tip of abdomen. Length, 0.62 mm.; width, 0.37 mm.

Male.—Unknown.

Type locality.—Cuba (?).

Type (*holotype*).—Cat. No. 24750, U.S.N.M.

A small female specimen obtained on sweet potatoes from Cuba, collected at Pascagoula, Mississippi.

LIPONYSSUS BURSA (Berlese).

Female.—Smaller than the female of *Dermanyssus gallinae.* Palpi rather large, extending to the tip of patella of leg I; chelicerae with cutting surfaces of both arms well developed, each arm tipped with a straight, spinelike hook set at angles to main axis. Dorsal shield large, sides convex behind the shoulders, at its greatest width falling short of the lateral margins of cephalothorax. Peritreme long and sinuous, reaching to opposite coxae I, and with a slight bulblike enlargement at its opening at the stigma. Sternal plate about twice as broad as long and lying entirely between second coxae. Anal plate about twice as long as broad, pointed in front; anus with longitudinal diameter considerably greater than transverse, rim uniform, and situated entirely in front of middle transverse line; paired setae situated halfway from rim of anus to lateral margins of plate; caudal area small, scobinate. Legs large; first and last pair subequal and longer than the two other pairs. Length, 0.72 mm.; width 0.41 mm.

Male.—Smaller than the female and more slender, especially in the abdominal region. Chelicerae stout; fixed arm longer than movable, doubly curved and with an inner toothlike protuberance. Dorsal shield similar to that of the female. Holoventral plate widest at its angular expansions between the second and third coxae, on the abdomen first slightly expanded then much narrowed in front of anus. Holoventral plate with the usual setae on sternal region, but on the abdominal region, with only two marginal pairs except for the anal pair and posterior median seta. Anus oval in outline and situated about twice its greatest diameter in front of posterior margin of holoventral plate. Length, 0.61 mm.; width, 0.29 mm.

Type locality.—Buenos Aires, Argentina.

Type.—(?) Not selected in original description.

North American records as follows: On chickens (Dallas Lab. acc. 2568); on poultry, Atlantic Beach, Florida, June, 1915; infesting house, North White Plains, New York, June, 1911; on porch of house, near Ottowa, Canada; on common hen, Canal Zone, Doctor Darling (No. 157); on chickens, Winter Park, Florida (Dallas acc. 2507); on poultry, Beltsville, Maryland, April 2, 1917; on poultry, Raymond, Illinois, 1919, by H. P. Wood; on poultry, Lafayette, Indiana, October 19 and 24, 1921.

Genus DERMANYSSUS Dugés.

KEY TO NORTH AMERICAN SPECIES.

a^1. Peritreme long and sinuous, extending beyond the second coxae. **D. gallinae** (Redi).

a^2. Peritreme short, broad, and almost straight, and not extending beyond the third coxae .... **D. americanus**, new species.

DERMANYSSUS GALLINAE (Redi).

Female.—Considerably larger than male. Palpi reaching the tips of femora of anterior legs; chelicera apparently with both arms present but each is needlelike, and the two fit together to form a single piercing structure. Dorsal shield large, convex behind the shoulders, and almost truncate behind. Peritreme with a slight bulb near stigma; extending to between coxae I and II. Sternal plate a transverse band of chitin passing between the anterior aspects of the second coxae but also reaching the first coxae; it is about four times as broad as long and bears a single pair of setae situated just behind the anterior margin. Anal plate with almost straight anterior margin; anus with greatest diameter longitudinally, rim thin except behind, where it is very thick, paired setae about twice as long as median setae; caudal area a slender marginal crescent. Legs large; anterior and posterior pairs longer than the others; tibia I slightly over twice as long as broad. Length, 0.69 mm.; width, 0.40 mm.

Male.—Much smaller than most of the females. Chelicerae each with the following armature: Two long, sinuous, tapering and adhering elements, one which surpasses the other with its distal, setiform, hooklike terminal portion; and a short spinelike, or styletlike, process, the latter probably representing the fixed chela. Dorsal shield similar to that of the female but more slender, more rounded at the posterior margin, and extending for almost the entire body length. Holoventral plate almost equally expanded into cusps between the first and second, second and third, third and fourth coxae. Anus situated less than its greatest diameter from the posterior margin of holoventral plate. Length, 0.61 mm.; width, 0.32 mm.

This species is probably present in all localities all over the world where chickens are raised to any extent. The following American hosts are known: Chickens, canaries, pigeons, English sparrows, and towhee (?). The species annoys also all domestic animals and man, but seldom attacks a mammalian host.

DERMANYSSUS AMERICANUS, new species.

Female.—Palpi extending to beyond the tips of the anterior femora; chelicera showing the two elements (arms) quite distinctly. Peritreme very short, not extending beyond third coxa; it is almost straight and is slightly bulbous near the stigmal opening. Sternal plate (apparently) crescentic and with three pairs of long, subequal setae. Anal plate slightly longer than broad, broadly rounded both in front and behind; anus with longitudinal diameter almost twice as great as transverse, rim thin in front, thicker on the sides, and very thick behind. The anus is situated almost entirely behind a middle transverse line; paired setae situated slightly behind the level of the anterior margin of anus; caudal area a narrow, crescentic area along margin of plate. Legs very short and stout; last pair falling far short of tip of abdomen. Length, 0.62 mm.; width, 0.36 mm.

Male.—Not known.

Type locality.—Washington, District of Columbia.

Type (holotype).—Cat. No. 24754, U.S.N.M., the lower of the two specimens on type slide selected.

Two individuals from English sparrow, Washington, District of Columbia, December 19, 1913, by R. S. Shannon.

Genus ALLODERMANYSSUS Ewing.

ALLODERMANYSSUS SANGUINEUS (Hirst).

Female.—Palpi slender, reaching to the tips of anterior femora; chelicerae showing plainly the needlelike elements representing both arms. Dorsal shield divided; anterior shield broadest at the shoulders, lateral margins behind the shoulders concave; posterior shield, circular, minute. Sternal plate squarish, lying entirely between the second coxae, with three pairs of subequal marginal setae. Anal plate egg-shaped in outline, anterior margin broadly rounded; anus situated centrally, rim very thin in front and on the sides, but enormously thickened behind; paired setae situated at the level of the center of the anus; median seta situated about two-thirds its length behind anus; caudal area reaching about halfway to the base of median seta. Legs very long and slender. Length, 0.91 mm.; width, 0.46 mm.

Male.—Not observed by the writer. Hirst states in regard to the male: "Dorsal shield wide anteriorly but progressively narrowed posteriorly, the terminal part of it being quite narrow and the extreme end blunt —." Also he states: "Sternoventral plate (holoventral plate of the writer) with the sides not so straight as in *D. muris*, and narrowed so as to form a distinct neck in front of the slightly enlarged anal portion; eight pairs of hairs and the usual unpaired posterior hair are present on this plate." The length of the body according to Hirst is 0.7 mm.

Type locality.—Egypt.

Type.—Has not been selected.

This description of female based on five specimens taken on a desk, Washington, District of Columbia, June 30, 1909, by Mr. Dewey. This is the only American record known to the writer. Hirst obtained specimens from *Mus, Arvicanthis*, and *Acomys*.

EXPLANATION OF PLATES ILLUSTRATING THE ANAL PLATE OF FEMALE.

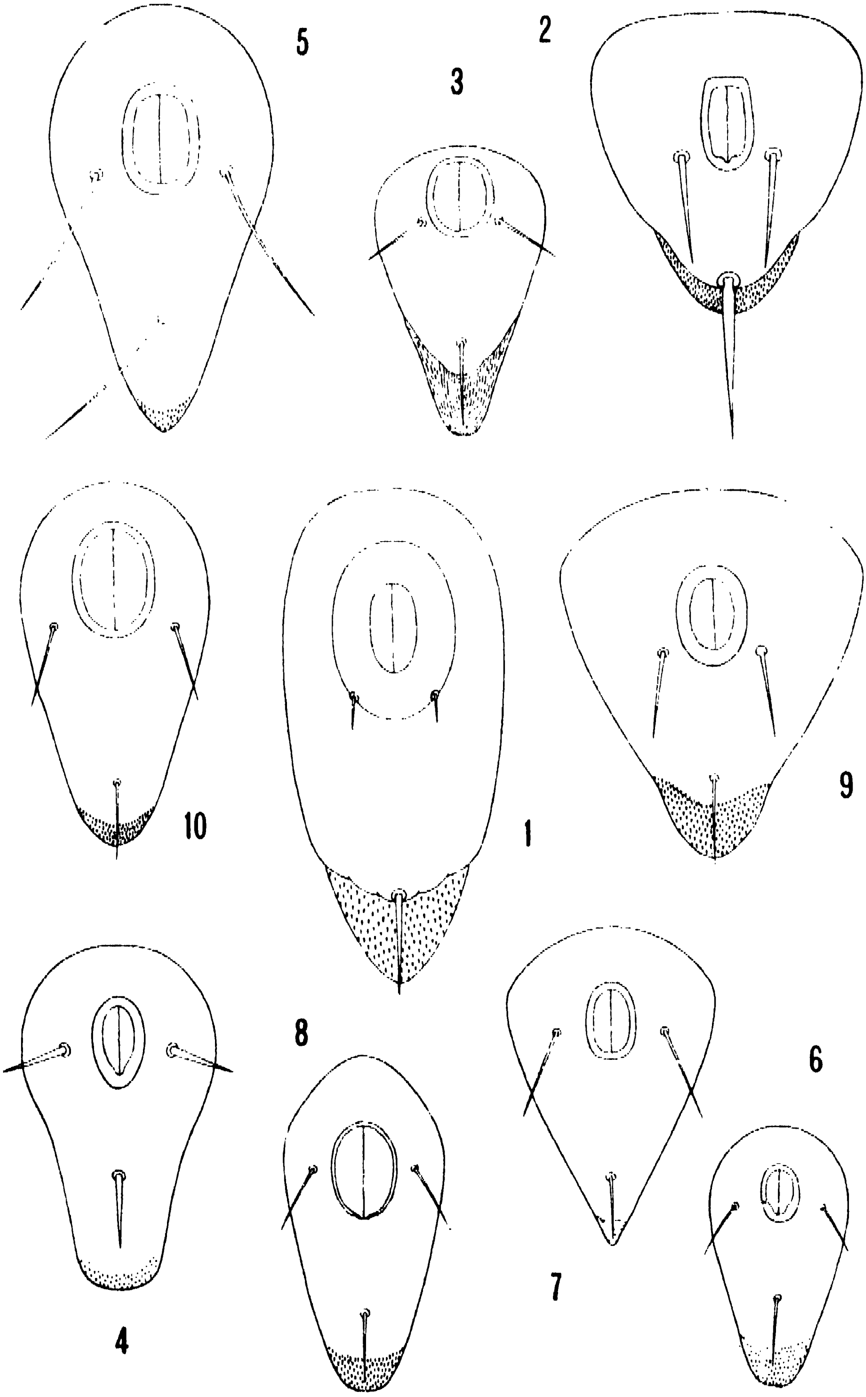
(All of these drawings are of the same magnification (× 400) and were made by the writer.)

Plate 1.

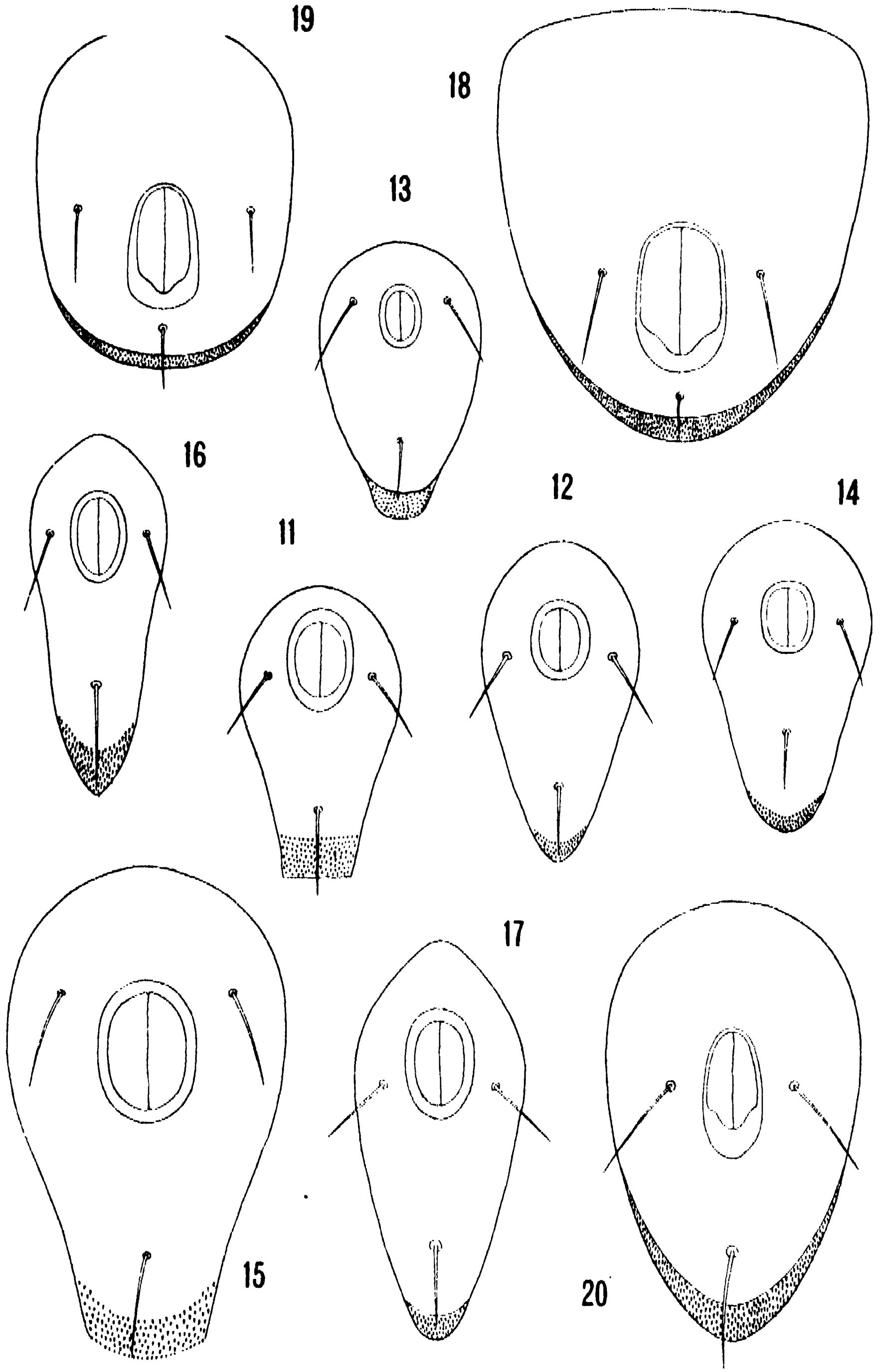
Fig. 1. *Tetragonyssus spiniger* (Ewing and Stover).
2. *Tetragonyssus bermudaensis* (Ewing).
3. *Ceratonyssus ceratognathus*, new species.
4. *Serpenticola serpentium* (Hirst).
5. *Ichoronyssus sternalis*, new species.
6. *Ichoronyssus isabellinus* (Oudemans).
7. *Leiognathus crosbyi* (Ewing).
8. *Leiognathus constrictus*, new species.
9. *Liponyssus triangulus*, new species.
10. *Liponyssus bacoti* (Hirst).

Plate 2.

Fig. 11. *Liponyssus pacificus*, new species.
12. *Liponyssus americanus* Banks.
13. *Liponyssus occidentalis*, new species.
14. *Liponyssus canadensis* Banks.
15. *Liponyssus montanus*, new species.
16. *Liponyssus tenuiscutatus*, new species.
17. *Liponyssus bursa* (Berlese).
18. *Dermanyssus gallinae* (Redi).
19. *Dermanyssus americanus*, new species.
20. *Allodermanyssus sanguineus* (Hirst).



DERMANYSSID MITES OF NORTH AMERICA.



DERMANYSSID MITES OF NORTH AMERICA.

FOR EXPLANATION OF PLATE SEE PAGE 28.

TERTIARY FOSSIL PLANTS FROM THE REPUBLIC OF HAITI.

By Edward W. Berry

Of the John Hopkins University, Baltimore, Maryland.

The romantic island of Haiti or Hispaniola, which next to Cuba is the largest of the Antilles, is divided politically into the Dominican Republic and the Republic of Haiti. At the invitation of the respective Governments the United States Geological Survey has, in the last few years, made geologic studies of the island under the direction of T. Wayland Vaughan. Geologic and paleozoologic data of great importance have been obtained, and a few collections of fossil plants were also secured. Those from the Dominican Republic, comprising small and for the most part poorly preserved materials of Tertiary age, were described by me in a recent paper.[1]

This paper is published by permission of the engineer in chief of the Republic of Haiti.

The work in the Republic of Haiti, in charge of W. P. Woodring, resulted in 13 small collections of fossil plants at the following localities:

B 320 F. Département du Nord, 7 km. north of Dondon on trail to Grande Rivière, altitude about 400 meters above sea level. J. S. Brown, collector. March 21, 1921.

B 91 F. Département du Sud, bluff on left bank of Bras à Gauche de Grande Rivière de Jérémie, about 10 km. south of junction of Bras à Gauche with Bras à Droit, and 5 km. north of Sources Chaudes de Dame Marie. J. S. Brown, collector. November 17, 1920.

B 272 F. Département du Nord, about 6 km. south by west of Plaisance on road to Ennery, north slope of Mt. Puilboreau, altitude about 550 meters above sea level. J. S. Brown, collector. February 25, 1921.

W 190 F (U. S. G. S. Tertiary invertebrate station 9907).[2] Département de l'Ouest, first high bluff on left bank of Rivière l'Ayaye above junction with Rivière Artibonite, about 18 km. northwest of Las Cahobas. W. P. Woodring, collector. January 10, 1921.

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[1] Berry, E. W., Proc. U. S Nat. Mus., vol. 59, pp. 117-127, pl. 21, 1921.

[2] Some of the localities have station numbers in the United States Geological Survey catalogue of Tertiary invertebrate fossil localities, as invertebrate fossils were collected at the same locality and from the same beds.

B 58 F. Département du Sud, La Ravine du Sud at intake on Canal d'Avezac, 2 km. north of Camp Perrin. In part from bluff about 100 meters southwest of intake, collected by W. S. Burbank, November 5, 1920; in part from locality 60 meters northeast of intake, collected by J. S. Brown, November 6, 1920.

B 88 F (U. S. G. S. Tertiary invertebrate station 9544). Département du Sud, valley of Bras à Droit de Grande Rivière de Jérémie, about 1 km. east of Chambellan Market on trail to Jérémie. J. S. Brown, collector. November 16, 1920.

B 311 F. Département du Nord, bed of ravine just west of road from Fort Liberté to Acul Samedi, about 5 km. northeast of Acul Samedi. J. S. Brown, collector. March 18, 1921.

B 95 F (U. S. G. S. fossil plant station 7541). Département du Sud, valley of Grande Rivière de Jérémie, on trail between Mafron and Fondelet Markets, about 12 km. southwest of Jérémie. J. S. Brown, collector. November 18, 1920.

W 233 F (U. S. G. S. Tertiary invertebrate station 9927). Département du Nord, north limb of Thomonde anticline, on trail from Thomonde to Hinche, about 4.5 km. north-northwest of Thomonde, altitude 350 meters above sea level. W. P. Woodring, collector. January 26, 1921.

B 139 F (U. S. G. S. fossil plant station 7542). Département de l'Ouest, trail from La Chapelle to Mirebalais, from ravine 1 km. west of highest locality on trail, about 10 km. southeast of La Chapelle, altitude about 300 meters above sea level. J. S. Brown, collector. December 18, 1920.

K 210 F (U. S. G. S. fossil plant station 7543). Département de l'Artibonite, ravine above highway bridge on road from St. Marc to Gonaïves, about 4 km. northeast of St. Marc. W. S. Burbank, collector. March 30, 1921.

W 185 F (U. S. G. S. fossil plant station 7544). Département de l'Ouest, cut along road from Mirebalais to Las Cahobas, on north side of ravine at foot of mountain on north side of gap. W. P. Woodring, collector. January 8, 1921.

W 96 F (U. S. G. S. fossil plant station 7555). Département du Sud, Vallée de l'Asile, south side of Rivière Serpent between Source Paul and Source Goudet. W. P. Woodring, collector. November 16, 1920.

Locality B 320 F, tentatively referred to the Cretaceous, furnished much broken fragments of linear leaves or small stems that are not determinable. Localities B 91 F and B 272 F, referred to the Eocene, yielded only small fragments, none of which are determinable. Locality W 190 F, referred to the Miocene, furnished undeterminable lignified stems. Localities B 58 F and B 88 F, referred to the Miocene, furnished respectively lignified stems and leaf fragments, none of which are determinable. Locality B 311 F, referred tentatively to the Pleistocene, furnished fragments of leaves, none of which are determinable. Locality B 95 F (station 7541) furnished the Dominican species *Guettarda cookei* Berry, undeterminable dicotyledonous fragments, and the *Gymnogramme* which occurs at two other localities. Locality W 233 F furnished fragments of dicotyledonous leaves, probably representing the genus *Ficus*. Localities B 139 F (station 7542) and K 210 F (station 7543) furnished one or two determinable species. Locality W 185 F (station 7544), from which the only considerable collection was made, furnished several identifiable forms. Locality W 96 F (station 7555) furnished *Chara* fruits from locustrine beds of Miocene age.

The locality W 185 F, which is considered of middle or upper Miocene age, contains the same *Gymnogramme* found at two other localities which are also referred to the Miocene. In the absence of clearly defined stratigraphic evidence I would be inclined to consider all three localities as of the same age. Although the present collections are not conclusive, I would be inclined to regard the few Miocene plants collected as pointing to late, rather than early Miocene age.

In addition to the few species named and described in the following pages the Miocene beds at station 7544 contain several fragments of what appear to be a species of *Terminalia*, a palm ray, and fragments of six or eight species of dicotyledons which might be readily determinable if a described fossil flora was known from this general area and horizon. The collection from station 7542 contains fragments of lauraceous leaves suggesting the genus *Nectandra*, and a second distinctly lauraceous type is present at locality B 88 F.

The flora described is too small to be of any especial significance. It is, perhaps, superfluous to point to its modern facies and tropical character. The nine species described, of which all but two are new, represent as many genera, seven families, and as many orders. A large number of forms that might reasonably be expected from the late Tertiary of this region are conspicuously absent, notably Leguminosae and members of the mangrove association. This appears to mean two things, namely, the absence of tidal mud flats and river estuaries, and suggests sandy or rocky shores. All of the leaves enumerated are of strand plants and all are maceration resisting forms, indicating that the other normal members of the Tertiary strand flora failed of preservation, at least at the discovered localities.

Family CHARACEAE.

Genus CHARA Linnaeus.

CHARA WOODRINGI, new species.

This species is represented by numerous calcareous and very fragile oogonia. Oogonium circular in cross section; elliptical in profile, slightly fuller distad than proximad; almost twice as long as wide; somewhat variable in size, which ranges from 0.5 to 0.8 millimeter in diameter, and from 0.75 to 1.25 millimeters in length. Proximal pole with a thin pentagonal calcareous plug which is frequently broken away. Apical pole consisting of the tips of the five cells which are enlarged and slightly thickened. The five cells of the wall make three revolutions, the spirals are hence low, and are roundly furrowed between the knife-edge extended keels of the cell margins.

These remains were found in association with a small fresh-water fauna at an altitude of 160 meters at the locality cited below. The species is decribed as new and named for the collector. It is possible that it may be the same as a still existing species, but as practically no systematic work has been done on the American Charas since the death of T. F. Allen, and I do not have adequate material of recent species for comparison, no other method of treatment is possible.

Although a few species have been described, practically nothing has been done on the fossil Charas of America, although they are known to be abundant at certain horizons, and their abundance when present in a deposit, their wide geographical range and minute but clearly differentiated specific expression tend to make them excellent horizon markers as Reid and Groves[3] have lately shown in an account of the Eocene forms from southern England.

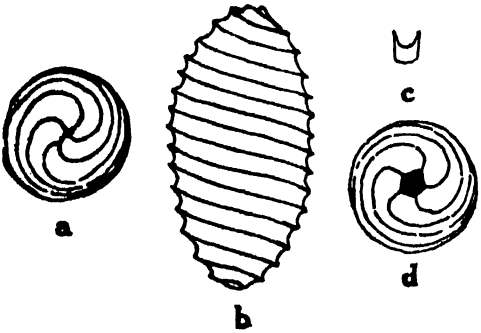

FIG. 1.—OOGONIUM OF CHARA WOODRINGI: *a*, APICAL VIEW; *b*, PROFILE VIEW; *c*, CROSS SECTION OF A SINGLE CELL, ALL GREATLY ENLARGED; *d*, BASAL VIEW.

Occurrence.—Miocene (station 7555).

Class LEPTOSPORANGIATAE.

Order POLYPODIALES.

Family POLYPODIACEAE.

Genus GYMNOGRAMME (of authors).

GYMNOGRAMME WOODRINGI, new species.

Plate 1, figs. 1–4.

In absence of more perfect and fertile material it is impossible to be sure of the generic position of this fern and I have therefore referred it to the genus *Gymnogramme* of Hooker and Baker with the clear recognition that this genus is a composite.[4] This type of sterile pinnule has been referred to *Acrostichum*, *Lomariopsis*, *Blechnum*, etc. The species is named for the collector, Dr. W. P. Woodring. The frond appears to have been pinnate and of few pinnules. The pinnules are lanceolate or ovate-lanceolate in form, with acuminate apex and base. The midvein is stout and prominent, expanded proximad to form a knoblike, subsessile base. Lateral veins numerous, closely spaced, parallel, diverging from the midvein at wide angles and pursuing straight courses to the margins, prevailingly simple, although a single instance of a basal dichtomy was observed.

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[3] Reid, C., and Groves, J., Quart. Journ. Geol. Soc. Lond., vol. 77, pp. 175-192, 1921.

[4] On this point see Underwood, L. M., Torrey Bot. Club Bull., vol. 29, pp. 617-634, 1902, and the subsequent systematic publications of W. R. Maxon.

Fragments of this fern are rather common and occur in the collections from three different localities. There are 15 specimens from station 7544, 9 specimens from station 7542, and a single specimen from station 7541. Except for the simple veins and entire margins this form is much like *Blechnum betijoquensis* Berry[5] of the Miocene of Venezuela, and it may be a species of *Blechnum,* some species of which have simple lateral viens. All of the localities from which the present species is recorded have been referred to the Miocene.

Occurrence.—Artibonite group, Miocene (stations 7544, 7542); Miocene (station 7541).

Cotypes.—Cat. Nos. 36606–36609, U.S.N.M.

Class DICOTYLEDONAE.

Order CHENOPODIALES.

Family NYCTAGINACEAE.

Genus PISONIA Linnaeus.

PISONIA CONDITI Berry.

Plate 1, fig. 5.

Pisonia conditi Berry, Proc. U. S. Nat. Mus., vol. 59, p. 119, pl. 21, fig. 1, 1921.

This species was described by me as follows: Leaves of small size, lanceolate, and slightly inequilateral in general outline, widest in the middle and equally pointed at the apex and base. Margins entire. Texture coriaceous. Length about 3.25 cm. Maximum width about 1.1 cm. Petiole very short and stout, only a millimeter or two in length. Midrib stout and prominent. Secondaries thin, immersed; five or six alternate camptodrome pairs diverge from the midrib at angles of about 45 degrees. These small leaves are characteristically inequilateral by having the basal margin flat on one side and curved on the other, with the distal margin flat on the opposite side and curved on the other side.

This species was based upon material of Tertiary (Miocene or Pliocene) age, collected at Sánchez, Dominican Republic. What appears to be identical with it is also present in the Republic of Haiti. The latter material shows a leaf slightly narrower than the type, but otherwise identical with it in both form and venation.

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[5] Berry, E. W., Proc. U. S. Nat. Museum, vol. 59, p. 559, pl. 107, fig. 1, 1921.

The genus *Pisonia* contains over a dozen fossil species ranging from the Upper Cretaceous through the Tertiary, in the Northern Hemisphere. In the United States there are three species in the Wilcox, one in the Claiborne and three in the Jackson Eocene, and an eighth in the Alum Bluff formation (Miocene). None of these are especially close to the present fossil. The existing species are numerous, chiefly tropical and in the Western Hemisphere. The genus is still present in the floras of both the Island Republics.

Occurrence.—Artibonite group, Miocene (station 7543). (Cat. No. 36610, U.S.N.M.)

Order GERANIALES.

Family SIMARUBACEAE.

Genus SIMARUBA Aublet.

SIMARUBA HAITENSIS, new species.

Plate 1, fig. 8.

Leaves pinnately compound, as suggested by their botanical relations, and by the sessile or subsessile, inequilateral, falcate character of the material. Leaflets ovate or elliptical in outline, widest in the median region, narrowed distad, and either rounded or shortly pointed. Base widely rounded and apparently sessile. The scanty amount of material (3 specimens) all lacks tips, so that the character of the apex is uncertain—one specimen suggests that it was emarginate, and the more complete specimen figured suggests that it may have been short pointed, although there is room in this specimen for it to have been rounded or emarginate. Margins full and entire. Texture subcoriaceous. Length about 3.5 cm. Maximum width about 1.75 cm. Midrib relatively very stout and prominent, curved. Secondaries numerous, stout, diverging from the midrib at wide angles, and camptodrome in the marginal region.

The genus *Simaruba*, which in the modern flora has a limited number of species confined to the equatorial region of the Western Hemisphere has a fossil species in the lower Eocene of the Mississippi embayment[6] and a second in the Miocene of Venezuela.[7]

Occurrence.—Artibonite group, Miocene (station 7544). A not certainly determined fragment from station 7542 appears to represent this species.

Holotype.—Cat. No. 36611, U.S.N.M.

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[6] Berry, E. W., U. S. Geol. Survey Prof. Paper 91, p. 252, pl. 54, fig. 7, 1916.

[7] Berry, E. W., Proc. U. S. Nat. Mus., vol. 59, p. 573, pl. 109, fig. 2, 1921.

Order THYMELEALES.

Family LAURACEAE.

Genus MESPILODAPHNE Nees.

MESPILODAPHNE HISPANIOLANA, new species.

Plate 1, fig. 11.

Leaves of medium size, about 9 cm. in length by 3 cm. in maximum width. Widest at or slightly below the middle, tapering upward to the acuminate tip, and downward to the cuneate base. Ovatelanceolate in general outline, and presumably with a short petiole, margins entire, somewhat, but very slightly undulate. Texture subcoriaceous. Midrib stout. Secondaries relatively thin, ascending, camptodrome; 4 or 5 irregularly spaced and not subparellel pairs diverge from the midrib at angles of 45 degrees or less, some curve upward with a single camptodrome arch, others are more ascending with several diminishing arches along the margins of the leaf. The tertiaries are prominent and typically lauraceous, forming polygonal meshes, passing imperceptibly into a similar areolation, not shown in the figure, but exactly like that shown in the accompanying text figure of the existing *Mespilodaphne glauca*, except that in the fossil it is on a smaller scale.

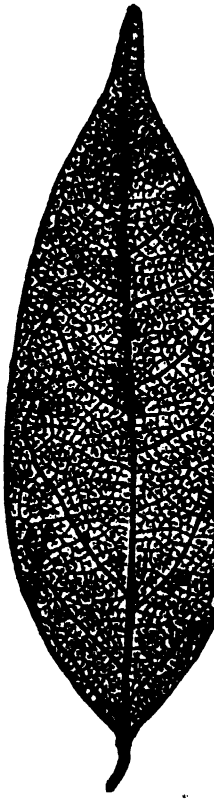


FIG. 2.—NATURE PRINT OF A LEAF OF MESPILODAPHNE GLAUCA FOR COMPARISON WITH THE FOSSIL.

Many fragments of these leaves n the collection show this areolation with great distinctness, but it is impossible to correctly depict it in a pen drawing. It is so characteristic that pieces of the leaf one-half an inch square are readily and positively identified. The present species, clearly distinct from previously described forms, represents a well defined type, appearing in the geological record at least as early as the lower Eocene in southeastern North America, and continuing down to the present, there being a large number of existing species of Mespilodaphne in the American tropics. The existing form most like the fossil is *Mespilodaphne glauca* of northern South America, and I have introduced an autoprint of a leaf of this species for comparison with the fossil and also to show the areolation that is such a clear-cut feature in the fossil form.

Occurrence.—Artibonite group, Miocene (station 7544).

Order EBENALES.

Family SAPOTACEAE.

Genus MIMUSOPS Linnaeus.

MIMUSOPS PRAEPARVIFOLIA, new species.

Plate 1, fig. 10.

Leaves elliptical in outline, about equally rounded at the apex and base, with full, entire margins. Texture coriaceous. Length about 4.5 cm. Maximum width about 2.75 cm. Petiole missing. Midrib stout and prominent. Secondaries numerous, about 10 pairs, diverging from the midrib at wide angles, camptodrome, largely immersed in the leaf substance. Tertiaries obsolete by immersion.

These leaves present obvious features allying them with the genus *Mimusops*, and represent a type that makes its appearance in the geological record in the lower Eocene of Southeastern North America, and continues down to the present when it is represented by about 40 species, found in the strand flora of the tropics and subtropics of both hemispheres.

The present fossil species is very close to the existing *Mimusops sieberi* A. DeCandolle of the Antilles, being somewhat wider and less elongate, but of the same general type. I have recognized this resemblance in the specific name chosen for the fossil, which is based on the Nuttallian name *parvifolia* which was formerly applied to this existing species.

Occurrence.—Artibonite group, Miocene (station 7544).

Holotype.—Cat. No. 36613, U.S.N.M.

Genus CHRYSOPHYLLUM Linnaeus.

CHRYSOPHYLLUM CAHOBASENSIS, new species.

Plate 1, fig. 9.

Leaves ovate-lanceolate in outline, widest at or slightly below the middle, and tapering upward to the acuminate tip and downward to the rounded-cuneate base. Margin entire. Texture coriaceous. Length about 6 cm. Maximum width about 2.5 cm. Petiole missing. Midrib stout, curved, prominent on the lower surface of the leaf. Secondaries stout, more or less immersed in the leaf substance, numerous, and subparallel, diverging from the midrib at wide angles, and abruptly camptodrome in the marginal region. Tertiaries mostly immersed in the leaf substance, a few transversely elongated ones are visible, as shown in the accompanying figure. Lower surface of the leaf covered with tiny dots which are interpreted as indicating pubescence in life.

This well-marked new species presents all of the essential features of the genus *Chrysophyllum*, and foreshadows the existing *Chrysophyllum oliviforme* Lamarck, of the Florida Keys and Antilles. The genus, which is confined to the tropical and subtropical regions of the world, is mostly American, and has been present in equatorial America since lower Eocene time.

Occurrence.—Artibonite group, Miocene (station 7544).

Holotype.—Cat. No. 36614. U.S.N.M.

Genus BUMELIA Swartz.

BUMELIA CUNEATAFOLIA, new species.

Plate 1, figs. 6, 7.

Leaves of small size, obovate and somewhat inequilateral in general outline, widest above the middle. Apex bluntly pointed. Base cuneate. Margins full and entire. Texture subcoriaceous. Length about 3.5 cm. Maximum width about 1.4 cm. Petiole short and stout, about 3 mm. in length. Midrib relatively stout, curved. Secondaries thin, diverging from the midrib at angles of about 45 degrees, camptodrome. Tertiaries as indicated in the accompanying enlarged figure.

This new species suggests comparisons with the somewhat larger existing *Bumelia angustifolia* Nuttall, of the Gulf coastal region of the United States, and *Bumelia cuneata* Swartz, of the Florida Keys and Antilles, the resemblance to the latter furnishing the specific name proposed for the fossil. The genus *Bumelia* has been present in southeastern North America since lower Eocene time, or earlier, and its score or more existing species are now confined to the warmer temperate and tropical parts of the Western Hemisphere.

Occurrence.—Artibonite group, Miocene (station 7544).

Holotype.—Cat. No. 36615, U.S.N.M.

Order RUBIALES.

Family RUBIACEAE.

Genus GUETTARDA Endlicher.

GUETTARDA COOKEI Berry.

Guetardat cookei Berry, Proc. U. S. Nat. Mus., vol. 59, p. 125, pl. 21, figs. 5, 6, 1921.

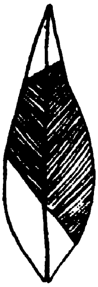
Fragmentary material from the Republic of Haiti is almost certainly this species which was described recently from the Miocene of the Dominican Republic. More recently, in studying Miocene plants from the Isthmus of Tehuantepec, a similar species of *Guet-*

tarda which I have tentatively identified as this species was discovered. This suggests Miocene land connection between Haiti and Central America, and emphasizes the importance of additional collections of plants from both of these areas in an attempt to confirm this suggestion.

Occurrence.—Miocene (station 7541.)

EXPLANATION OF PLATE 1.

FIGS. 1-4. *Gymnogramme woodringi*, new species.
  Fig. 1. Station 7542.
  Figs. 2-4. Station 7544.
5. *Pisonia conditi*. Station 7543.
6, 7. *Bumelia cuneatafolia*, new species. Station 7544.
  Fig. 7. Enlarged to show venation.
8. *Simaruba haitensis*, new species. Station 7544.
9. *Chrysophyllum cahobasensis*, new species. Station 7544.
10. *Mimusops praeparvifolia*, new species. Station 7544.
11. *Mespilodaphne hispaniolana*, new species. Station 7544.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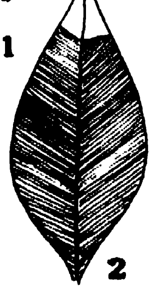
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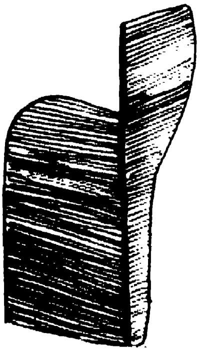
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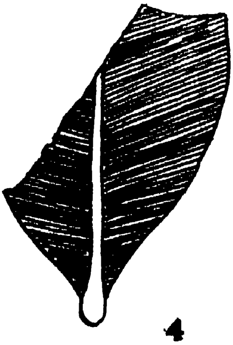
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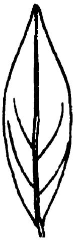
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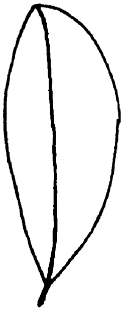
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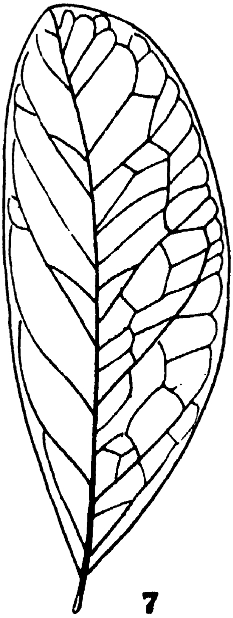
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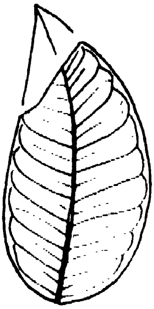
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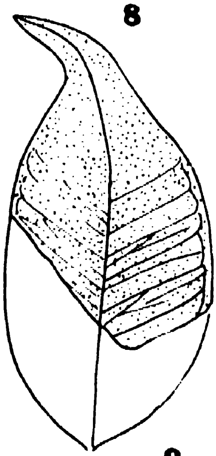
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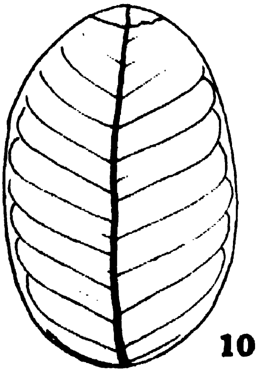
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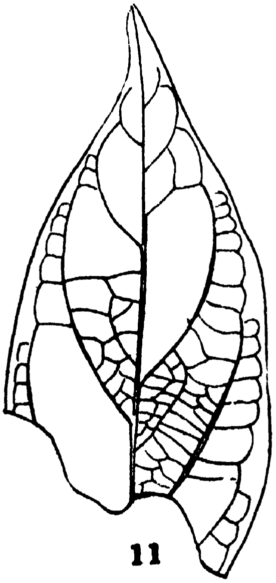
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TERTIARY FOSSIL PLANTS FROM HAITI.

FOR DESCRIPTION OF PLATE SEE PAGE 10

NOTES ON THE MINERALOGY OF THREE GOUGE CLAYS FROM PRECIOUS METAL VEINS.

By Earl V. Shannon,

Assistant Curator, Department of Geology, United States National Museum.

INTRODUCTION.

Ore bearing veins of the so-called "true-fissure" type, whether the ore has developed by filling of open cavities or by replacement of wall rock adjacent to fissures, in a majority of instances are accompanied by more or less of clayey material which is commonly called selvage, "talc," or clay gouge. From the relationships and appearance of this clayey material it would naturally be considered to be merely rock from the walls of the fissure which had been rendered clayey and plastic by extremely fine grinding by movements along the fissure. Were radical chemical changes not anticipated one would expect the clay gouges of veins in granitic of other igneous rocks to consist of finely comminuted fragments of quartz, feldspar, and ferromagnesian silicates with perhaps a little kaolin derived from the feldspar and perhaps some iron oxide or hydroxide derived from iron-bearing silicates. In slates, shales, and especially quartzites, rocks resistant to chemical action, the gouges would not be expected to differ appreciably either chemically or mineralogically, from the inclosing rock. For many years the clayey materials accompanying veins received little attention. It is only recently that students of ore deposits have learned that the gouges are most frequently radically different from the minerals which make up the rocks of the walls, and that, by their nature and composition these clays yield valuable information as to the character of the vein-forming solutions. Thus sericite, or finely divided fibrous muscovite, is known to be widespread as a constituent of gouges while kaolinite, alunite, serpentine, talc, and leverrierite are known from veins of certain types. In examining gouge materials from Idaho gold and silver veins in the United States National Museum the writer has recently analyzed mineralogically homogeneous clays from three mines. The results of these examinations are given in some detail below.

LEVERRIERITE GOUGE FROM THE BLACK JACK MINE, IDAHO.

The first specimen to be examined (Museum Cat. 24679) was labeled "tallow clay, Black Jack vein, Carson district, Owyhee County, Idaho." This proved to consist of the peculiar aluminous silicate leverrierite. Exact details in regard to the occurence of the clay are not obtainable. Lindgren mentions[1] clayey minerals at several points in this vein. Where the vein is exposed at the surface by trenches small streaks of quartz and valencianite with comb structure appear, stained and incrusted by hematite and limonite and imbedded in soft brownish rhyolite, often with considerable masses of clay, resembling kaolin. In the granite the vein is intimately connected with a basaltic dike averaging 2 feet in width which is perpendicular or dips steeply west. Although the dike is often soft and clayey, its walls are always sharply defined and are separated from the granite or the vein by clay seams. The vein lies on the footwall or hanging wall of the dike or both, with an average width of 10 inches. A sharp contact with clay gouge separates vein from dike but the gangue is not uncommonly frozen to the granite. The lower part of the vein is in granite while the upper part is in extrusive rhyolite. The gangue consists of quartz and valencianite while the principal ore minerals are black finely divided argentite and chalcopyrite which is highly auriferous.

Physical properties.—The specimen, which has been cut into a rectangular block while plastic, is smooth and resembles a hard soap. Its exterior is pale pink, the color obviously being due to discoloration or darkening on exposure as the interior is snowy white. The structure is laminated and platy but suggests schistosity rather than micaceous cleavage such as was found in the Colorado leverrierite. There are air holes in the Idaho material which indicate that the material was originally moist and and very plastic and that the specimen was kneaded somewhat while in this condition. When placed in water the material softens slowly and cracks up gradually. At the end of several hours immersion it had not disintegrated in the manner characteristic of bentonite. Its hardness in the specimen is about 1. The mineral has every appearance of a soaplike amorphous clay. When crushed between the teeth there is an absolute absence of any grit and, when in its original moist condition, the consistency must have been such as to make the name "tallow clay" exceedingly appropriate.

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[1] Waldemar Lindgren. Gold and Silver Veins in Idaho. 20th Annual Report, U. S. Geol. Surv., pt. 3, pp. 135-140, 1899.

Optical properties.—Under the microscope the material is transparent, colorless, and entirely crystalline with a finely foliated or felted-fibrous structure. The birefringence is moderately high. The indices of refraction measured are, parallel to the cleavage $\gamma = 1.513$; perpendicular to the cleavage, $\alpha = 1.488$, both ± .003. The birefringence indicated is 0.025 ± .003. These indices separate this clay clearly from both sericite and kaolinite which have much higher indices. The Idaho material compares very well with the lowest set of values given by Larsen[2] for leverrierite, the optical data thus being in agreement with the chemical evidence as discussed below.

Pyrognostics.—Heated in a closed tube the clay yields abundant neutral water at a very moderate temperature. In the forceps it decrepitates mildly and fuses with moderate ease on thin edges to a white blebby enamel, the fused portion becoming markedly incandescent.

Composition and chemical properties.—Material which had been proven free from contaminating impurities by careful optical examination was available in quantity for investigation and the analysis was carefully made upon ample material. The dehydration phenomena were not studied in detail as it is planned to do this as part of another research later. The loss of water at 110° C. was found to be 14.48 per cent, the mineral reaching constant weight for this temperature with two hours heating. The first hour the loss was 14.28 per cent. During the second hour an additional loss of 0.20 was obtained while several hours additional exposure to the same temperature occasioned no further loss in weight. When exposed again to the air of the room, however, the material proved to be exceedingly hygroscopic and a sample which had been dried to constant weight at 110° C. regained all of its original water content upon standing overnight in the air of the room. A similarly dehydrated sample regained 2.18 per cent of its original weight upon standing overnight in a desiccator over fresh calcium chloride. Samples dehydrated at 110° C. and allowed to stand overnight over concentrated sulphuric acid show a gain of several per cent following which they can not again be brought to the original dry weight at this temperature. This suggests that sulphuric acid has been adsorbed, an assumption which has not as yet been confirmed. This phenomenon has repeatedly been observed by the writer to occur with hygroscopic mineral powders, and the use of sulphuric acid desiccators has accordingly been discontinued in mineral analysis.

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[2] Esper S. Larsen. U. S. Geol. Surv. Bull. 679, p. 245, 1921.

The analysis gave the results and ratios tabulated below:

Analysis and ratios of leverrierite from Idaho.

SiO_2	45.32	0.7516	75.16	1.00×3
Al_2O_3	27.84	.2724	27.68	1.10×1
Fe_2O_3	.70	.0044		
CaO	2.76	.0492	5.60	1.12×⅕
MgO	.16	.0039		
K_2O	.12	.0013		
Na_2O	.10	.0016		
H_2O+110°C	8.16	.4529	125.66	1.00×5
H_2O−110°C	14.48	.8037		
Total	99.64			

These ratios yield the formula:

$$1/5\ RO.\quad R_2O_3.\quad 3SiO_2.\quad 5H_2O.$$

or expanded:

$$RO.\quad 5R_2O_3.\quad 15SiO_2.\quad 25H_2O.$$

The miscellaneous bases may in all probability be safely assumed to replace the basic hydrogen, the simplified formula becoming

$$Al_2O_3.\quad 3SiO_2.\quad 5H_2O.$$

Obviously there must remain a considerable amount of uncertainty regarding the nature of this mineral, an uncertainty not cleared by the discussion by Wherry and Larsen.[3] These authors add univalent and bivalent bases to the trivalent alumina, tentatively assuming that they occur as a replacement of this oxide. They show that the various minerals of the group vary in base ($Al_2O_3+R''O+R'_2O$): silica ratio from 1:1.86 to 1:2.76. Unpublished investigations in this laboratory indicate a much wider range. To quote from the above authors "this variableness in composition within definite limits suggests that a mineral group is represented or at least a species including several subspecies, as is the case, for instance, with muscovite."

The leverrierite group of minerals is now being investigated here with especial reference to the bentonitic clays and any speculation now with reference to the constitution of the group would be premature. Consequently it is deemed sufficient, for the present to record the properties and composition and mode of occurrence of the Idaho mineral.

SERICITIC MUSCOVITE GOUGE FROM THE CARROLL-DRISCOLL MINE, BOISE BASIN, BOISE COUNTY, IDAHO.

While sericite has for some years been recognized as an important mineral of metalliferous ore deposits and its mineralogical identity with muscovite has been sufficiently demonstrated, there are in the literature very few records of thorough chemical investigation of material from metalliferous veins, especially upon samples of demonstrated homogeneity and freedom from extraneous impurities. Some specimens of very excellent and typical material of this sort from a gold vein in the Boise Basin recently having been received at the Museum, the writer undertook to examine the mineral especially to secure data for incorporation in his manuscript on the minerals of Idaho which is in preparation. The results seem worthy of detailed presentation here. Grateful acknowledgment is due Mr. Clarence S. Ross, of the United States Geological Survey, for assistance in determining the optical properties of the mineral, proving the homogeneity of the analyzed material by optical methods, and in devising a method for freeing the mineral from contaminating impurities.

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[3] Esper S. Larsen and Edgar T. Wherry. Leverrierite from Colorado. Journ. Wash. Acad. Sci., vol. 7 p. 208, 1917.

Occurrence.—The specimen came in a series collected by Edward L. Jones, jr., of the United States Geological Survey. Jones'[4] description of the deposit gives such an excellent idea of the occurrence of the mineral that it may advantageously be quoted entire, as follows:

> The Carroll-Driscoll group comprises 14 claims which extend in a northeasterly direction from the end lines of the Gold Hill group to Garden Valley Pass. The property was worked in the early days and many thousand dollars' worth of gold was produced from surface workings and by sluicing disintegrated veins on the Ivanhoe and Capital claims at the head of California Gulch. The principal development work on this group consists of two tunnels, 178 feet apart, on the Ivanhoe claim. The upper tunnel, which is several hundred feet long, is now partly caved. It is a shallow drift on the vein, which strikes N. 30° E. and dips steeply east. Considerable ore has been produced but the amount is not definitely known. The ore consists of veinlets of massive pyrite and a little quartz which carry free gold. The country rock is granite.
>
> The lower tunnel is driven on a course N. 60° W. for 1,450 feet. It intersects a shear zone 135 feet wide, which contains several sulphide veins in zones of more intense shearing. These veins trend from N. 30° E. to north and dip steeply east. The largest vein is near the hanging wall of the main shear zone, and its width ranges from 3 to 12 feet. The zone is further explored by a drift on its hanging wall and by short crosscuts driven to the main vein. The shear zone carries an abundant flow of water, which, with the softness of the vein matter, renders mining somewhat difficult.
>
> The vein matter is composed largely of a soft white gouge which incloses the sulphides. The gouge is sericite, a secondary mica derived from the alteration of feldspars. Pyrite in well developed crystal aggregates or individuals, is the dominant sulphide in the gouge, but here and there are fragments of older vein material in which quartz, calcite, pyrite, galena, sphalerite, and tetrahedrite were recognized. These sulphides, however, have largely been ground up and incorporated in the gouge. It is evident that there have been two general periods of sulphide deposition and that extensive alteration and movement have occurred in the vein subsequent to the first period. Pyrite is the latest mineral in the seri-

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[4] Edward L. Jones, jr., Lode Mining in the Quartzburg and Grimes Pass Porphyry Belt, Boise Basin, Idaho. U. S. Geol. Survey, Bull. 640, p. 104 ,1916.

cite gouge, as proved by its well-developed crystal form. According to E. F. Blain superintendent of the property, the vein assays from $5 to $15 a ton in gold and $2 to $3 a ton in silver. No assays were made to determine whether the pyrite of the lower tunnel contains any gold and silver, but it is thought more probable that these metals are contained in the older sulphides.

The samples examined were numbered SI 82 and the label accompanying them reads "sericite from shear zone." They consist in the main of the fine scaly sericite containing disseminated pyritohedral crystals of pyrite up to 1 cm. in diameter. One of the larger specimens contained a mass of the quartz containing sulphides of the first mineralization and this was washed free from sericite by scrubbing with a brush under water. This was a nodule of white quartz which was rounded as if by solution, which contained pyrite, galena, tetrahedrite, and a colorless to light resin or greenish-yellow sphalerite, the latter in well-formed crystals up to 1 cm. in diameter. There was also a little of a peculiar appearing mineral of grayish purple color with well-defined cleavage which agreed in optical properties and blowpipe reactions with barite.

Physical properties.—In the hand specimen the sericite is visibly micaceous with a very finely foliated structure and distinctly silky luster. The color varies from cream or dirty white to pale greenish. When moistened it is plastic with a greasy feel.

Optical properties.—The optical properties were very kindly worked out by Mr. Ross, who obtained the data given in column 1 below. In column 2 are given for comparison the properties of normal muscovite as given in Larsen's tables.[5]

Comparison of optical properties of sericite and muscovite.

1. Sericite (Ross):	2. Muscovite (Larsen):
Biaxial.	Biaxial.
Negative (−).	Negative (−).
2V 25°	2V = 40°
X = *c*.	X = *c*.
Indices:	Indices:
$\alpha = 1.550 \pm .003$	$\alpha = 1.561$
$\beta = 1.585 \pm .003$	$\beta = 1.590$
$\gamma = 1.587 \pm .003$	$\gamma = 1.594$
Birefringence .037.	Birefringence .033.

While the indices of refraction are slightly lower and the birefringence is somewhat higher than those given for normal muscovite it is noteworthy that the optical properties are essentially those of muscovite.

Pyrognostics.—Heated before the blowpipe this sericite fuses on thin edges to a white enamel. This property is important since muscovite and kaolinite are commonly listed as infusible and leverrierite has heretofore been separated from these minerals in a qualitative way on the basis of its fusibility. Heated in a closed tube the mineral first darkens and then becomes white again and yields water having an acid reaction.

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[5] Esper S. Larsen. The microscopic determination of the nonopaque minerals. U. S. Geol. Surv. Bull. 679, p. 252, 1921.

Composition and chemical properties.—Optical examination by Mr. Ross of the material which had been hand selected for analysis showed it to be essentially homogeneous except for minor amounts of two minerals, one certainly colorless zircon in minute crystals, the other an isotropic colorless mineral which was doubtless the light-colored sphalerite mentioned above. These were entirely removed by a method which deserves mention as it is applicable to numerous micaceous minerals. A screen was selected which had meshes smaller than a majority of the sericite flakes and the material was screened repeatedly, alternating the screening with rolling the powder, spread thinly on plate glass, with a hardened steel rod. The brittle impurities were thus crushed so as to pass the screen while the micaceous sericite remained behind. Even before purification the impurities amounted only to a fraction of 1 per cent.

Upon analysis the purified sample gave the following results and ratios:

Analysis and ratios of sericite from Idaho.

	Per cent.		Ratios.	
SiO_2	46.58	0.7725	77.25	1.00×2
Al_2O_3	37.46	.3665	37.15	.96×1
Fe_2O_3	.80	.0050		
CaO	trace.			
MgO	1.16	.0288		
K_2O	6.38	.0677	44.32	1.15×1
Na_2O	.64	.0103		
H_2O above 110°	6.06	.3364		
H_2O below 110°	.30			
Total	99.38			

The ratios yield the formula $(H,K)_2O$, Al_2O_3, $2SiO_2$ with the univalent bases—potash and water—replaced to a slight extent by magnesia. The bases are somewhat high which probably indicates that a part of the water, about 1 per cent, is adsorbed. The remainder of the water (5.03 per cent) is essential to the mineral which agrees with the normal muscovite formula. The percentage of alkalies is 7.02 while the water is 5.03, the former being slightly higher in weight. Moleculary, however, the ratio of water to alkalies is 3.58 : 1.00. Assuming the mineral to be an isomorphous mixture of a theoretical pure potash muscovite molecule ($KAlSiO_4$) and a theoretical hydrogen muscovite end molecule ($HAlSiO_4$), the latter is greatly in excess in the present muscovite. The very low content of low temperature water is noteworthy.

CLAY GOUGE FROM GARFIELD TUNNEL, DE LAMAR DISTRICT, IDAHO.

Lindgren[a] writes regarding the vein clays of the De Lamar district, Owyhee County, Idaho, as follows: "It remains to mention the white chalky or 'talcose' material often forming parts of the vein. This is sometimes a product of metasomatic replacement of the rhyolite, but may also form the filling between the comb quartz in veins and vugs. All of this material is exceedingly fine grained and with highest magnifying power appears as scaly aggregates of faint double refraction. To judge from the determinations available, it is either pure kaolinite or a mixture of that mineral with one of sericitic character." Lindgren gives determinations of soda, potash, and water above and below 100° C. on six gouge clays from various localities in the De Lamar district and the percentages of these constituents, while very variable, substantially support his conclusion that the clays are mixtures of kaolinite and sericite in various proportions. However, while it is true that sericite and kaolinite are both common minerals, they represent the results of alteration processes of divergent character, operating on the same primary materials and it would be noteworthy if these processes had acted simultaneously to produce a mixture of the two minerals. Some light on the problem is given by the analysis of the sericite from Boise County described above since that material, though proven by optical methods to be a well characterized and homogeneous mica, is of such a composition that, on the basis of its water and alkalies contents, it would certainly have been interpreted as a mixture of kaolinite and sericite. Only one of the original specimens tested for Lindgen was available for more thorough examination. This he describes as follows:

A soft white material from the Garfield Tunnel, south side, end of drift, containing much marcasite in arborescent forms yielded:

	Per cent.
Water (H_2O) $-100°$	2.20
Water (H_2O) $+100°$	4.60
Potassa (K_2O)	6.52
Soda (Na_2O)	.18

This also is probably kaolinite mixed with a sericitic mineral.

The modern method of investigating such fine-grained materials under the microscope by immersing them in media of known refractive index allows the easy detection of mechanical admixtures of minerals of dissimilar indices of refraction. The above-mentioned specimen from Lindgren's collection was accordingly reexamined with the following results.

Physical properties.—In the hand specimen the material from the Garfield Tunnel is a very fine-grained clay. The specimen consists of approximately equal parts of marcasite and the clay, the former mineral having a peculiar dendritic form from the arrangement of its crystals in branching fernlike growths. Although interiorly the clay is white as mentioned by Lindgren, the exterior of the specimen is now pinkish and fresh fractures gradually turn from white to greenish and finally pink, probably from the oxidation of minute amounts of ferrous sulphate formed by breaking down of the marcasite. The clay portion of the specimen is compact and shows contraction cracks. When soaked in water the material cracks up gradually without conspicuous swelling.

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[a] Waldemar Lindgren. Gold and silver veins in Idaho, 20th. Ann. Rept., U. S. Geol. Survey, pt. 3, pp. 171-172, 1899.

Optical properties.—Under the microscope the material is very fine grained and is composed of aggregates, shreds, and flakes which give a brown dispersion color in transmitted light. Between crossed nicols the mineral shows rather high birefringence. It is seen, when immersed in an oil of its own refractive index, to be homogeneous although slightly variable in index, with the following average indices:

$$\alpha = 1.547, \qquad \gamma = 1.556, \qquad \gamma - \alpha = 0.009.$$

The apparent birefringence is much greater, as seen under the microscope, then the birefringence indicated above. Upon standing in oils for about a week the indices had not changed appreciably.

Composition and chemical properties.—Upon analysis selected material from this specimen yielded the following results:

Analysis and ratios of clay from Garfield Tunnel.

SiO_2	45.94	0.7618	76.18	15.24×5	1.00×5
Al_2O_3	34.14	.3341	34.20	17.10×2	1.12×2
Fe_2O_3	1.26	.0079			
CaO	.84	.0149	47.97	15.99×3	1.05×3
MgO	.18	.0044			
K_2O	6.52	.0692			
Na_2O	.18	.0027			
H_2O+110° C	7.00	.3885			
H_2O−110° C	2.70	.1500	15.00	15.00×1	1.00×1
Total	98.76				

Chemically this, like the sericite from Boise County described above, is like a muscovite in which the potash has to a considerable extent been replaced by water although ratios of this last analysis do not agree quite so well with the simplified muscovite formula, the higher silica ratio indicating some admixture of the phengite molecule. The bases also are high as compared with the silica but, owing to the finer and more felted structure, this sample probably has more adsorbed water than the Boise County specimen. The chief chemical difference, however, lies in the additional molecule of water which is given off at 110°C. On the basis of this water content and its indices of refraction this sample might be called leverrierite although this content of water is much less than that ordinarily found in leverrierite.

SUMMARY AND DISCUSSION.

Of three gouge clays from gold and silver veins in Idaho, which were examined, all are homogeneous and crystalline with microscopic micaceous structure. All of these, from their occurrence and appearance under the microscope, would be classified as sericite. On the basis of their alkali content the first would be classified as kaolin while the two latter would be interpreted as mixtures of sericite and kaolin in approximately equal amounts. On their optical properties the first would be considered leverrierite, the second muscovite, and the third leverrierite.

The first described, the clay from the Black Jack vein, is a well-defined leverrierite, practically free from alkalies and iron and with a large content—nearly 15 per cent—of water which is released at a temperature of 110° C. and is quickly regained when the material is allowed to stand in air. The second, from the Carroll-Driscoll claim in the Boise Basin, Idaho, is a well-defined muscovite optically but chemically it is found to be muscovite in which the theoretical potash-free hydrogen-muscovite molecule is greatly in excess of the potash-muscovite molecule. It contains practically no water which is released at a temperature of 110° C. The third clay, from Garfield Tunnel, De Lamar district, Idaho, which had been called a mixture of sericite and kaolinite is homogeneous and similar to the last in composition but has lower indices of refraction and the equivalent of one molecule of water which is released at 110° C.

From these data it is concluded that muscovite, or at least sericite, varies from a theoretical hydrogen-free potash molecule on one hand to a potash-free hydrogen molecule on the other and that most sericites are intermediate. Consequently the potash content is no index to the amount of sericite present in a clay and many of those clays from veins which have been interpreted, on the basis of their alkali content, as mixtures of sericite and kaolinite, may well have been homogeneous sericites. Since the presence of sericite does not necessarily imply the presence of abundant potash it is unsafe to assume that this type of alteration in a given area was accomplished through the medium of potash-bearing thermal waters until it is definitely established by analysis that the sericitized rocks are notably higher in alkali content than the same rocks where not affected by the alteration.

Many such sericitic materials are more properly classified as leverrierite although from existing knowledge leverrierite can not be separated from sericitic muscovite except on the basis of its low temperature water. Leverrierite may be defined as a clayey mineral of micaceous structure conforming in general with muscovite in composition but with a large content of low temperature water, i. e., water which is released upon heating to 110° C., and which is quickly regained upon exposure to the air. The mode of combination of this water is at present not understood. That it is not inherent to the physical structure is proven by the fact that other specimens of identical structure, form and size of grain are practically devoid of low temperature water. Careful determination, by proper apparatus, of the dehydration curves of these materials may give some information bearing on this problem. At present the geologist, dealing with ore deposits can not be criticized for failing to distinguish between sericite and leverrierite and he is justified, where opportuuity for detailed mineralogic work is lacking, in treating all such materials simply as sericite.

The fusibility test is unreliable as all three of the above-described clays are fusible before the blowpipe.

DESCRIPTION OF TWO SQUALODONTS RECENTLY DISCOVERED IN THE CALVERT CLIFFS, MARYLAND; AND NOTES ON THE SHARK-TOOTHED CETACEANS.

By Remington Kellogg,

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INTRODUCTION.

When the study of paleontology was less advanced than it is at present, any announcement of the discovery of prehistoric animals unlike the living indigenous fauna was usually received with some suspicion. In spite of this distrust, many attempts were made by the early writers to explain the presence of fossil remains of marine mammals in strata above the sea level or at some distance from the seashore. In one of these treatises[1] is found what is, apparently, the first notice of the occurrence of fossil remains referable to shark-toothed cetaceans. The author of this work figures a fragment of a mandible, obtained from the tufa of Malta, which possesses three serrate double-rooted molar teeth.

Squalodonts as such were first brought to the attention of paleontologists in 1840, by J. P. S. Grateloup,[2] a French naturalist primarily interested in marine invertebrates. In the original description of *Squalodon,* Grateloup held the view that this rostral fragment from Leognan, France, belonged to some large saurian related to *Iguanodon.* Following the anouncement of this discovery, Von Meyer[3] called attention to the teeth of this fossil, and concluded that the specimen was referable to some flesh-eating cetacean. A year later, Grateloup[4] concurred in this opinion. One other specimen should be mentioned in this connection, but, unfortunately, its relationships are quite uncertain. This specimen consists of a single tooth which was thought to bear resemblance to some pinniped by Von Meyer[5] and named *Pachyodon mirabilis.* Although this name has two years' priority over that of Grateloup's it should not be revived in this sense until the tooth is

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[1] Scilla, A., La Vana Specvlazione distingannata dal Senso, Naples, p. 123, pl. 12, fig. 1, 1670; idem De Corporibus Marinis Lapidescentibus quae defossa Reperiuntur, Rome, p. 54, pl. 12, fig. 1, 1759.

[2] Grateloup, J. P. S., Actes Soc. Linn. de Bordeaux, vol. 11 for 1839, No. 56, p. 346, 1840.

[3] Meyer, H. von, Neues Jahrbuch für Mineralogie, Stuttgart, pp. 587-588, 1840.

[4] Grateloup, J. P. S., Idem., pp. 567-568, 1841.

[5] Meyer, H. von, Idem., p. 414, 1848.

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compared with those of true squalodonts and our knowledge concerning it supplemented by the acquisition of the additional material.

Since Von Meyer's and Grateloup's time the group has become better known, and its geographic and geologic range widely extended. The most important discoveries in regard to the group since 1840, as well as the best preserved specimens, have been the anouncement of *Squalodon antverpiensis* by Van Beneden, 1861, *Rhizoprion* [=*Squalodon*] *bariensis* by Jourdan, 1861, *Squalodon bariensis* [=*zitelli*] by Zittel, 1876-77, *Prosqualodon australis* by Lydekker, 1894, and *Neosqualodon assenzae* by Dal Piaz, 1904.

No records of the occurrence of squalodonts are known to the writer from Africa, Asia, or from the Pacific coast of North America. This seems rather remarkable in view of the fact that a number of forms are known from the Tertiary deposits of Europe, and from similar deposits along the Atlantic coast of North America. Other representatives of this group have been found in Patagonia, Australia, and New Zealand. This peculiar distribution may be explained in part by the inadequacy of our knowledge concerning the Oligocene and Miocene marine formations of Asia and Africa. Although considerable progress has been made in the study of marine invertebrates and land vertebrates of the Pacific coast Province, comparatively little is known concerning its cetacean fauna.

The possibilities for widespread dispersal of the cetaceans are exceptionally great in view of the absence of physical barriers, and the chief controlling factor, apparently, is the food supply. It is fairly well known that some of the larger cetaceans, especially the whalebone whales, perform migrations between definite points. Other cetaceans have been observed only in rather limited areas, and a few forms are known which are restricted to large fresh-water rivers and their estuaries. It is thought that some of the predaceous forms, such as the dolphins, follow the routes of the oceanic currents. In case of the squalodonts which were, judging from their serrate dentition, remarkably well adapted for a predatory life and hence could secure an adequate food supply wherever fish or dolphins were present in sufficient numbers to insure easy capture, one would expect their geographic range to be practically cosmopolitan. Under similar prevailing conditions of aquatic life the distribution of the squalodonts should have been much the same as that of the Killer Whale (*Orcinus*).

In the Northern Hemisphere the squalodonts appear in considerable numbers during the Miocene. Their geological history in this region previous to the Miocene is unsatisfactory, resting as it does upon the occurrence of cetaceans in the Ashley River phosphate beds of South Carolina and upon the discovery of an imperfectly known squalodont of small size in the Upper Oligocene of Germany.

The South Carolina deposits have yielded a relatively large assemblage of cetaceans and a number of these have been referred to as squalodonts. The described forms are: *Ceterhinops longifrons*, and *Squalodon debilis*, *modestus*, *pelagius*, *protervus* Leidy (not Cope), and *tiedemani*. All of these are either from the sands or the phosphate beds of the Ashley River, except *Squalodon tiedemani*, which is from the closely approximate Wando River in the same State. All those referred to *Squalodon*, except *pelagius* and *tiedemani*, are known only from detached teeth. *Squalodon pelagius* is represented by a fragment of the left maxilla bearing a single tooth; its relationships are uncertain. Fragments of the upper and lower jaws of *Squalodon tiedemani*, with teeth, represent all that is known concerning this form. These fragments suggest a cetacean of large size. A restudy of the Ashley fauna has convinced the writer that most of the cetaceans mentioned above are not squalodonts, as will be shown in another part of this review. Two other interesting cetaceans have been obtained from the Ashley phosphate deposits. The only parts known of one of these, *Colophonodon holmesii*, are single-rooted teeth, and the skull of the other, *Agorophius pygmaeus*, is unlike any known squalodont.

The decision as to the age of these fossils necessarily depends upon geological considerations. It is known that there is a thin layer of marl[6] of Upper Miocene age which overlies the Ashley (Eocene) marl. In this connection it may be well to quote from William H. Dall[7] regarding the age of these Miocene marls:

> I have no hesitation in concluding that the rock from which the phosphate nodules are derived is of Upper Miocene age, or at least that its fauna, while unmistakably Miocene, is more really related to the Chesapeake Miocene than to the older beds of the Chipola Epoch. The phosphatization of the rock was of course later than its formation and perhaps might have taken place like that of the very similar Peace River, Florida, phosphate pebbles, during Pliocene time.

Since many of the fossil cetaceans were obtained from the bed of the Ashley River, it by no means follows that they are all derivatives of those beds which have been determined as Eocene. If these cetaceans were really Eocene forms, then it might be said that the squalodonts had attained a considerable development in North America at that time. We would expect, however, that these supposed Eocene forms would present primitive characters. Unfortunately, the fragmentary condition of some of the remains makes it difficult to form an opinion in this matter. Taken as a whole, they can not be said to be more primitive than those squalodonts conceded to be of Miocene age. Excepting the genus *Agorophius*, the general statement may be made that no fossil shark-toothed cetaceans have thus far been discovered in North America which are so primitive that they must be regarded as probably older than the Miocene.

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[6] Sloan, E., Catalogue of the Mineral localities of South Carolina, Bull. No. 2, ser. 4, South Carolina Geol. Surv., Columbia, pp. 290-292, 469, 1908.

[7] Dall, W. H., Amer. Journ. Sci., ser. 3, vol. 48, p. 30, 1894.

As remarked above, the great majority of known squalodonts are from deposits conceded to be of Miocene age. On the basis of the fauna, as represented by the squalodonts, there is no good reason for considering most of the fossil cetaceans derived from deposits in the Ashley River region as older than the Upper Miocene. *Agorophius pygmaeus*, apparently, is derived from deposits of Upper Eocene age, that is, from the Ashley marl. The age of some of the other cetaceans will probably be disputed until some competent geologist obtains additional specimens and reports on their occurrence.

Our present information regarding this group is chiefly the result of accidental discovery of isolated specimens, and our knowledge concerning them should rapidly widen whenever a systematic search is made for their remains in marine formations. The fact that cetaceans are capable of traveling long distances should place them foremost among animals used for correlating widespread deposits. They occur not only in typical marine deposits but in estuaries and river deltas as well. The main difficulty seems to be a morphological one, for we are confronted with the task of determining whether or not a species has a long geologic range. Evolution may have been and probably was extremely slow in modifying the physical characteristics of many of the cetaceans. From the evidence afforded by fossil cetaceans we see that some of the families have no living representatives while some of the genera have made little if any progress since the Miocene so far as skeletal characters are concerned. The squalodonts represent an archaic group which are still imperfectly known and the surviving types probably disappeared before the close of the Pliocene. A possible exception to this statement rests on a record of a squalodont found in association with quaternary land mammals in Italy.

For the privilege of studying the squalodont material in the National Museum I am indebted to C. W. Gilmore and J. W. Gidley. The type of *Squalodon tiedemani* was intrusted to me for study by E. O. Hovey of the American Museum of National History at the suggestion of W. D. Matthew. A collection of cetaceans from the Ashley River phosphate deposits, including squalodonts, has been placed in my hands for comparison by R. S. Lull of Yale University. Gerrit S. Miller, jr., has extended facilities for studying the skeletons of living cetaceans. W. L. McAtee has verified a reference for me at Philadelphia and E. A. Preble has kindly read the manuscript. The text figures were drawn by J. R. Malloch and the photographs (pls. 1–4) were retouched by Miss Ludwika Wieser. Furthermore

the writer wishes to acknowledge his indebtedness to John C. Merriam, president of the Carnegie Institution of Washington, for the assistance and kindly interest he has shown in this problem.

Acknowledgments are due to the following for correcting or confirming the age determinations of those forms which occur in their respective countries: Prof. Giorgio Dal Piaz, Museo Geologico dell'Università di Padova, Italy; Prof. Giuseppe Stefanini, Museo Geologico, Firenze, Italy; Dr. Federico Sacco, R. Politecnico, Gabinetto di Geologia, Castello del Valentino, Torino, Italy; Dr. H. Gerth, Rijks Geologisch-Mineralogisch Museum, Leiden, Holland; Prof. Othenio Abel, Paleobiologischer Lehrapparat der Universität, Wien, Austria; and J. McDonald, acting director, Dominion Museum, Wellington, New Zealand. Acknowledgments also are due to George P. Merrill and T. Wayland Vaughan.

Before describing the specimens from the Calvert Cliffs, Maryland, it was necessary to examine most of the literature relating to the animals in question, which had been accumulating during the past 84 years. Since Grateloup recorded the occurrence of *Squalodon* in France nearly 50 names have been proposed for remains of cetaceans which were assumed to be squalodonts at some time after their original publication. A review of these forms follows. It will be noticed that no attempt is made to offer a full bibliography for each species, and that only such references are given as are considered to be pertinent to the present study. In considering their claims to recognition the specific names may best be taken up alphabetically.

NOMENCLATURE.

MICROCETUS AMBIGUUS (Meyer).

Phoca ambigua MUENSTER, G. G. VON, Neues Jahrbuch für Mineralogie, Stuttgart, p. 447, 1835 (*nomen nudum*).—MEYER, H. VON, Beiträge zur Petrefacten-Kunde (herausgeg. von Georg. G. zu Muenster), Bayreuth, vol. 3, p. 1, pl. 7, figs. 1–8, 1840 [Giebel, C. G., Odontographie, Leipzig, pl. 36, figs. 10, 11*a*, 11*b*, 14, 1855].—MOLIN, R., Sitzungsber. math.-naturwiss. Cl. Kais. Akad. der Wissenschaften, Wien, vol. 35, No. 8, p. 118, 1859.

Type specimen.—Consists of two one-rooted premolars and two two-rooted molars, a fragment of a rib, and a dorsal vertebra. Type in the "Paläontologische Sammlung" at Munich, Germany.

Type locality.—Found 30 feet below the surface in the Tertiary marl of the Osnabrück Basin near Bünde, Oldenburg, Germany. Upper Oligocene.

Subsequent allocation.—This form belongs in the group of squalodonts characterized by *Neosqualodon* Dal Piaz according to Abel.[8] The absence of accessory cusps on the anterior cutting edge of the molars[9] and the shape of those on the posterior edge shows clearly that this form is quite unlike those specimens referred to the genus *Neosqualodon*. The general appearance of these small teeth, including the presence of coarse striae at the base of the enamel crown of the molar as well as the compressed crowns of the premolars,[10] suggest a closer relationship with *Squalodon* than with *Neosqualodon*. Since it does not belong to any previously described genus, it may hereafter be known as *Microcetus ambiguus* (Meyer).

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[8] Abel, O., Mém. Mus. Roy. Hist. Nat. Belgique, Bruxelles, vol. 3, footnote, p. 66, 1905.

[9] Meyer, H. von, Beiträge zur Petrefacten-Kunde, vol. 3, pl. 7, figs. 1*a*, *b*; 2*a*, *b*, *c*· 3, 1840.

SQUALODON ANTVERPIENSIS Van Beneden.

Squalodon antverpiensis VAN BENEDEN, P. J., Bull. Acad. Roy. Sci., des Lettres et des Beaux-Arts, Bruxelles, ser. 2, vol. 12, No. 7, p. 28, 1861; Mém. Acad. Roy. Sci. Belgique, Bruxelles, vol. 35, pp. 14-43, pl. 1, 1865.

Type specimen.—Consists of the major portion of a fragmentary rostrum with teeth in situ—that is, three premolars and seven molars. This species has a long symphysis, as is shown by the two fragments of the mandible belonging to the type. Additional material provisionally assigned to the species includes several cervical vertebrae, a clavicle, humerus, cubitus, and phalanx. Type in the "Musée Royal d'Histoire Naturelle de Belgique," at Brussels, Belgium.

Type locality.—Fort No. 4, at Vieux-Dieux, in the vicinity of Antwerp, Belgium. The type comes from the "Sables inferieurs d'Anvers" which according to Abel[11] are referable to the Bolderian or Upper Miocene.

Subsequent allocation.—A few years later Van Beneden[12] described and figured a portion of the symphysial region of the lower jaws of a second squalodont derived from the deposits around Antwerp. This specimen possesses premolars exhibiting sawlike cutting edges and the enamel crowns of the teeth are fluted or ornamented with large coarse striae similar to the ornamentation on the incisors of the type specimen. On the whole there is considerable resemblance between the teeth of the two specimens, and Van Beneden was undoubtedly right in referring them to the same species.

The descriptions and figures of Van Beneden are probably inexact in many respects for several discrepancies are to be observed in the account as given by Abel[13] and as drawn up by Van Beneden.

NEOSQUALODON ASSENZAE Dal Piaz.

Neosqualodon assenzae DAL PIAZ, G., Abhandl. Schweiz. Paläont. Ges. Geneve, vol. 31, No. 5, pp. 1-19, with 1 pl., figs. 1*a*, 1*b*, 2, 3*a*, 3*b*, 4*a*, 4*b*, 5*a*, 5*b*, 6*a*, 6*b*, 1904.

Type specimen.— Consists of a posterior fragment of the rostrum (the tip of rostrum and the brain case posterior to narial openings are wanting) and a fragment of a mandible, both with serrate cheek teeth in situ. The mandible possessed ten, and possibly more, serrate cheek teeth. Type in the "Museo Geologico dell'Istituto superiore di Firenze," Italy.

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[10] Meyer, H. von, Beiträge zur Petrefacten-Kunde, vol. 3, pl. 7, figs. 4*a*, *b*; 5*a*, *b*, 1840.

[11] Abel, O., Mém. Mus. Roy. Hist. Nat. Belgique, Bruxelles, vol. 1, p. 42, 1901; vol. 3, p. 50, 1905.

[12] Van Beneden, P. J., Mém. Acad. Roy. Sci. Belgique, Bruxelles, vol. 37, pp. 1-13, pl.—, figs. 1-2, 1868.

[13] Abel, O., Mém. Mus. Roy. Hist. Nat. Belgique, Bruxelles, vol. 3, pp. 47-50, 1905.

Type locality.—From white limestone ["calcare di Ragusa"] of Scicli, near Modica, Sicily. Langhiano superiore, or Lower Miocene.

Subsequent allocation.—The species is quoted by Dal Piaz and is credited to Forsyth-Major without reference or date. This may be a manuscript name of Forsyth-Major, for the name stands: "*Squalodon assenzae* Major (in sched.)."[14]

This form apparently is very closely related to *Neosqualodon gastaldii.*

SQUALODON ATLANTICUS (Leidy).

Macrophoca alantica LEIDY, J., Proc. Acad. Nat. Sci. Philadelphia [vol. 8], pp. 220–221, 1856.

Squalodon atlanticus LEIDY, J., Journ. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 7, pp. 416–418, pl. 28, figs. 4–7, 1869.

Type specimen.—Consists of three molar teeth. Type Nos. 11217, 11218, 11219, Academy of Natural Sciences of Philadelphia.

Type locality.—Miocene marl of Shiloh, Cumberland County, New Jersey. Upper Miocene.

Subsequent allocation.—This species was placed in the genus *Squalodon* by Cope.[15] More recently Allen[16] refers this species to the genus *Basilosaurus*, but gives no reasons. The appearance of these teeth is so unlike the zeuglodonts and resembles so closely the type of teeth that are now regarded as pertaining to the squalodonts, that it is difficult to see on what grounds such an allocation would be based.

PROSQUALODON AUSTRALIS Lydekker.

Prosqualodon australis LYDEKKER, R., Annales del Museo de La Plata, Palaeont. Argentina, vol. 2, for 1893, pp. 8–10, pl. 4, figs. 1, 1*a*, 1*b*. April, 1894.

Type specimen.—Consists of a nearly complete skull with teeth in situ. Lydekker[17] states that the roots of the molariform teeth have coalesced, but are defined by a deep groove. He further states that in the structure of the nasals the genus *Prosqualodon* is more generalized than *Squalodon,* while the characters presented by the teeth show it to be more specialized. Type in the "Museo de La Plata," Argentine Republic.

Type locality.—A marine deposit on the coast in the Territory of Chubut, Patagonia, Argentine Republic. The locality was stated more precisely by Ameghino[18] as the Patagonian formation at Port Madryn on Bahia Nueva, Chubut Territory. The Tertiary formation at Port Madryn [New Bay] was considered by Ortmann[19] to belong to the Patagonian beds and he held that these beds are Lower Miocene.

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[14] Dal Piaz, G., Abhandl. Schweiz. Paläont. Ges. Genove, vol. 31, p. 3, 1904.

[15] Cope, E. D., Proc. Acad. Nat. Sci. Philadelphia [vol. 19], pp. 132, 153–154, 1867.

[16] Allen, G. M., Mem. Boston Soc. Nat. Hist., vol. 8. No. 2, p. 282, 1916.

[17] Lydekker, R., Proc. Zool. Soc. London, p. 921, 1899.

[18] Ameghino, F., Bol. Inst. Geogr. Argentina, vol. 17, p. 99, 1896.

Subsequent allocation.—This skull has been studied quite thoroughly by Lydekker, while Abel[20] has figured a restoration of a second skull and discussed its affinities. In discussing the relationships of this genus, Stromer[21] remarked that according to its organization and geological age, it should rather be named *Postsqualodon.* The mandibles, teeth, vertebrae, tympanic, and periotic studied by True[22] were collected by the late J. B. Hatcher in the Patagonian beds at San Julian, Santa Cruz Territory.

AGRIOCETUS AUSTRIACUS Abel.

See *Agriocetus incertus* (Brandt).

SQUALODON BARIENSIS BARIENSIS (Jourdan).

Rhizoprion bariensis JOURDAN, C., Comptes Rendus Acad. Sci. Paris, vol. 53, pp. 959, 962, 1861.—LORTET, L., Archiv. Mus. d'Hist. Nat. de Lyons, vol. 4, pp. 315–316, pls. 25 *bis*-25*ter*, 1887.

Type specimen.—Original description was based upon a nearly complete skull with teeth in situ. The tip of the rostrum was missing and Jourdan thought that portion was lost or pulverized at the time of collection. However, Gervais later obtained this missing fragment from Matheron and communicated the fact to Van Beneden[23] who published his letter together with a drawing of the same. Type in the "Muséum des Sciences Naturelles" at Lyon, France.

Type locality.—Obtained in a stone quarry at the village of Bari, near Taulignan, not far from Saint-Paul-Trois-Chateaux, Department of Drome, France, from the lower level of a bed of marine limestone. Basal Helvetian[24] or Middle Miocene.

Subsequent allocation.—This species was referred to the genus *Squalodon* by Zittel.[25] The acquisition of a second specimen of this interesting squalodont, which possesses a nearly complete rostrum and dentition, has so supplemented the data afforded by the mutilated type specimen that little remains unknown concerning the appearance and proportions of the skull. This find was announced by Paquier[26] and the specimen was obtained from the quarries of Saint-

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[19] Ortmann, A E., Princeton Patagonian Exped., vol. 4, Palaeontology I, pt. 2, 1901–1906, pp. 275, 285, 297; Berry, E. W., Proc. First Pan-Pacific Sci. Conference held under auspices of Pan-Pacific Union, Special Publ. No. 7, pt. 3, p. 861, Bishop Museum, Honolulu, Hawaii, 1922.

[20] Abel, O., Sitzungsber. math.-naturw. Cl. Kais. Akad. der Wissenschaften, Wien, vol. 121, pt. 1, pp. 57–64, pls. 3, 1912.

[21] Stromer, E. von, Beitr. Pal. und Geol. Oesterr.-Ungarns und d. Orients. Wien, vol. 21, p. 172, footnote, 1908.

[22] True, F. W., Smithson. Misc. Coll. (Quart. Is.), vol. 52, pt. 4, Publ. 1875, pp. 447–455, text figs. 77, 78; pl. 43, fig. 2; pl. 44, figs. 1–8; pl. 45, figs. 1–6, 1909.

[23] Van Beneden, P. J., Bull. Acad. Roy. Sci. Belgique, Bruxelles, ser. 2, vol. 13, No. 5, p. 463, pl. —, (colored), 1862.

[24] Deperet, C., Archiv. Mus. Hist. Nat. de Lyon, vol. 4, pp. 278–279, 1887.

[25] Zittel, K. von, Palaeontographica, Stuttgart, vol. 24, p. 235, 1876–77.

[26] Paquier, V., Mém. Soc. Géol. de France, Paris, Paleontologie, vol. 4, fasc. 4, Memoire No. 12, pp. 12–15, pl. 18, figs. 1–10, 1894.

Paul-Trois-Chateaux, Department of Drome, France. The limestone of formation was asigned to the Burdigalian stage or Lower Miocene.

SQUALODON BARIENSIS BELLUNENSIS Dal Piaz.

Squalodon bariensis JOURDAN, var. *bellunensis* DAL PIAZ, G., Palaeontographia Italica, Pisa, vol. 6, p. 312, pls. 26–29, and text fig. 1, 1901.

Type specimen.—Consists of the rostral portion of a skull with eight teeth in situ, and a fragment of a mandible with four teeth. Type probably in the "Museo geologico Giovanni Capellini" at Bologna, Italy.

Type locality.—"Dell'arenaria miocenica di Belluno," Compartment of Venetia, Italy. Langhiano or Lower Miocene.

Subsequent allocation.—This form, judging from the original description and the published figures, is very closely related to, if not identical with, *Squalodon bariensis* (Jourdan).

SQUALODON BARIENSIS LATIROSTRIS Capellini.

Squalodon bariensis JOURDAN, var. *latirostris* CAPELLINI, G., Mémorie della R. Accademia delle Scienze dell'Istituto di Bologna, ser. 5, vol. 10, pp. 437–445, pl. (unnumbered), figs. 1–2, 1903. [Vernacular name "latirostre" used in text (p. 445); latinized name *latirostris* forms legend for plate.]

Type specimen.—Consists of a somewhat damaged cranium and two fragments of the rostrum. The occipital, postorbital, and ethmoidal portions of the cranium are either lost or incomplete. A portion of the mandible, fragments of ribs, and some caudal vertebrae belonging to this specimen are mentioned but not figured. Type in the "Museo geologico dell'Istituto dell'Università di Padova," Italy.

Type locality.—"Arenaria calcarifera dei Grumi dei Frati presso l'ospedale di Schio," Compartment of Venetia, Italy. Langhiano or Lower Miocene.

Subsequent allocation.—A study of the figures in the article of Capellini convinces the writer that the relationships of this specimen are with *Squalodon bariensis*. The amount of variation to be expected in skulls of this genus is not known and the acquisition of additional skulls will be needed to confirm the validity of this subspecies.

SQUALODON BORDAE (Gervais).

Delphinus bordae GERVAIS, P., Zoologie et Paléontologie françaises, Paris, ed. 1, vol. 1, p. 153, pl. 41, fig. 8 [reversed]; 1848-1852 [based upon *Delphinoides gratelupi* (part) Pedroni [27]].

Squalodon bordae ABEL, O., Mem. Mus. Roy. Hist. Nat. Belgique, Bruxelles, vol. 3, pp. 27, 33, 1905.

Type specimen.—Consists of an incomplete mandible without teeth; the posterior end of the mandible including the angle and the condyle as well as the extreme tip are missing. Specimen was formerly in the collection of H. Arnozan, "directeur de l'Asile départemental des aliénés de la Charente-Inférieur," France.

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[27] Pedroni, P.M., jr., Actes Soc. Linn. de Bordeaux, vol. 14, pp. 107-109, 1845.

Type locality.—"Grès marin ?" of Léognan, Department of Gironde, France. Mayencian or Lowermost Middle Miocene.

Subsequent allocation.—Von Meyer[28] was the first to suggest that this mandible represents a squalodont, for in his remarks he says that *Delphinus* (*Champsodelphis*) *bordae* Gervais is not a dolphin but is referable to *Squalodon grateloupii* [= *Squalodon typicus*, new species]. In 1900, Abel[29] mentioned the specimen and discussed it in connection with *Champsodelphis macrognathus* Brandt. More recently, the same writer[30] discussed the dental formula of this specimen in comparison with others, and his account gives one the impression that he considered it a valid species.

ZEUGLODON BREVICUSPIDATUS (Tate MS.) Hall.

See *Parasqualodon wilkinsoni* (McCoy).

STEREODELPHIS BREVIDENS (Dubreuil and Gervais).

Delphinus brevidens DUBREUIL and GERVAIS, P., Comptes Rendus Acad. Sci. Paris, vol. 28, No. 4, pp. 135–136, January–June, 1849.

Stereodelphis brevidens GERVAIS, P., Zool. et Paléont. françaises, Paris, ed. 1, p. 152, pl. 9, figs. 4–6, 1848–1852; ed. 2, pp. 310–311; Atlas, vol. 5, pl. 9, figs. 4–6, 1859.

Type specimen.—Consists of a fragment of a lower jaw with alveolae, including part of the coronoid process and a portion of the horizontal ramus. Two single-rooted and blunt-crowned teeth were also referred to this species. Type in the "Museum National d'Histoire Naturelle" at Paris, France.

Type locality.—Found in a block of marine limestone that was being used in the construction of new additions to the "Faculte de Medicine" at Paris. Dubreuil and Gervais stated that this stone was obtained from quarries in the vicinity of Castries, to the east of Montpellier, Department of Herault, France. Later, Gervais[31] published more explicit information, namely, "la molasse dite pierre de Marabel," near Castries. Helvetian or Middle Miocene.

Subsequent allocation.—A new genus *Stereodelphis* was proposed for this species by Gervais. Other writers have considered that it should be referred to the genus *Squalodon*. This species was considered to be a synonym of *Squalodon grateloupii* by Van Beneden,[32] while Trouessart[33] placed it in the synonymy of *Squalodon bariensis*. There is reason to believe that this fragment of the lower jaw should be referred to the group characterized by *Eurhinodelphis*. Certain peculiarities are brought out in the figure given by Gervais[34] which favor such an allocation. The backward extension of the alveolar gutter upon the base of the coronoid, the lack of well-defined septa between the alveolae for the two-rooted molars, and the configuration and general appearance of the fragment as a whole agrees well with *Eurhinodelphis* as represented by material in the United States National Museum.

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[28] Meyer, H. von, Palaeontographica. Beiträge zur Naturgeschichte der Vorwelt, Cassel, vol. 6, pp. 42. 47, September, 1856.

[29] Abel, O., Denkschriften d. K. Akad. d. Wiss. math.-naturw. Kl., Wien, vol. 68, p. 840, 1900.

[30] Abel, O., Mém. Mus. Roy. Hist. Nat. Belgique, Bruxelles, vol. 3, pp. 27, 33, 1905.

[31] Gervais, P., Zool. et Paléont. franç., Paris, ed. 1. vol. 1, p. 152, 1848-1852.

[32] Van Beneden, P. J., Mem. Acad. Roy. Sci. Belgique, Bruxelles, vol. 35, p. 70, 1865.

[33] Trouessart, E. L., Cat. Mamm. viv. foss., Berlin, fasc. 5, p. 1012, 1898.

[34] Van Beneden, P. J., and Gervais, P., Ostéographie des Cétacés vivants et fossiles, Paris, p. 435; Atlas, pl. 28, figs. 14, 14*a*, 1880.

SQUALODON BURGUETI (Gervais).

Smilocomptus burgueti GERVAIS, P., Comptes Rendus Acad. Sci. Paris, vol. 28, No. 21, p. 645, footnote, January–June, 1849; Zool. et Paléont. franç., Paris, ed. 1, vol. 1, p. 161, pl. 41, fig. 4, 1848-1852.

Type specimen.—Name proposed provisionally for a somewhat flattened caniniform tooth. Type in the "Museum d'Histoire Naturelle" at Bordeaux, France.

Type locality.—Found in a shell marl at Salles, Department of Gironde, France. This shell marl is considered to belong to the Upper Miocene by Tournouer.[35] Tortonian or Middle Miocene.

Subsequent allocation.—This species was considered to be a synonym of *Squalodon grateloupii* by Van Beneden.[36] More recently, Trouessart[37] placed it in the synonymy of *Squalodon bariensis*.

TRIRHIZODON CATULLI (Molin).

Pachyodon catulli MOLIN, R., Sitzungsber. math.-naturw. Cl. Kais. Akad. der Wissenschaften, Wien, vol. 35, No. 8, p. 126, pls. 1–2, 1859.

Type specimen.—This species was based upon 11 teeth, including 8 which have fairly complete crowns, 2 of which are figured as three-rooted, and 3 as two-rooted, as well as 3 other imperfect teeth. G. Dal Piaz has recently informed the writer that Molin's original specimens are now lost. They were formerly in the Museum of the University of Padova, Italy.

Type locality.—"dall'arenaria grigia di Libàno circa due ore al Nord Est. di Belluno,"[38] compartment of Venetia, Italy. This breccia was stated by Molin[38] to belong to an Eocene formation. This determination is probably incorrect, for De Zigno[39] assigns this deposit to the Miocene, and Longhi[40] as a result of his study of the fossil plants places these breccias in the Aquitanian stage. Langhiano or Lower Miocene.

Subsequent allocation.—This species was placed in the genus *Squalodon* by Brandt.[41] In 1890, Cope[42] erected a new genus, *Trirhizodon*, to include certain species of squalodonts having "some of the posterior superior molars three-rooted." No type species was designated and while some may hold that it was Cope's intention to apply this proposed name to *Squalodon gervaisii* in accordance with a key drawn up by him in 1867[43] he did not actually do so. The inference drawn from his remarks is that he was aware of more than one form having three-rooted upper molars. In view of the above facts it seems advisable to select a form which not only possesses such features as will fall within the limits of his diagnosis but also one that will best illustrate these peculiarities. Since *Pachyodon catulli* of Molin best fulfills these requirements it is here selected as the type of *Trirhizodon* Cope and may stand as *Trirhizodon catulli* (Molin).

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[35] Tournouer, R., Actes Soc. Linn. de Bordeaux, ser. 3, vol. 9, pp. 119-161, 1873; Vaughan, T. W., Proc. First Pan-Pacific Sci. Conference held under auspices of Pan-Pacific Union, Special Publ. No. 7, pt. 3, table opposite p. 820, Bishop Museum, Honolulu, Hawaii, 1922.

[36] Van Beneden, P. J., Mém. Acad. Roy. Sci. Belgique, Bruxelles, vol. 35, p. 70, 1865.

[37] Trouessart, E. L., Cat. Mamm. viv. foss., Berlin, fasc. 5, p. 1012, 1898.

[38] Molin, R., Sitzungsber. math.-naturw. Cl. Kais. Akad. der Wissenschaften, Wien, vol. 35, p. 126.

[39] Zigno, A. de., Mém. del Istituto Veneto di Sci., Lett. ed Arti, Venezia, vol. 20 [extract separately paged, 7], 1876.

[40] Longhi, P., Atti Soc. Veneto-Trentina Sci. Nat. resid. in Padova, ser. 2, vol. 3, fasc. 1, p. 77, 1897.

[41] Brandt, J. F., Mém. Acad. Imp. Sci. de St.-Petersbourg, ser. 7, vol. 20, No. 1, pp. 330, 332, 1873.

[42] Cope, E. D., American Naturalist, vol. 24, No. 283, p. 603, July, 1890.

MICROZEUGLODON CAUCASICUM (Lydekker).

Zeuglodon caucasicum LYDEKKER, R., Proc. Zool. Soc. London, pt. 4, No. 38, pp. 559–561, pl. 36, figs. 1–3, April 1, 1893.

Type specimen.—Based upon the posterior portion of a left mandibular ramus containing four serrate molars, a second fragment of a jaw with five broken teeth, a left humerus, and an imperfect caudal vertebra. Loaned to Lydekker by H. Sjögren, of Upsala, Sweden.

Type locality.—"A Tertiary deposit, in company with a number of fish remains, in the Caucasus." This deposit is referable to the "Sumgait-serien" or Eocene according to Hjalmar Sjögren.[44] Both Lydekker[45] and Abel[46] have questioned this correlation, the former suggesting a Miocene age, and the latter an Upper Oligocene age for the cetacean remains.

Subsequent allocation.—Stromer[47] was the first to point out the radical differences which exist between *Zeuglodon caucasicus*, so far as represented by skeletal remains, and true *Zeuglodon*. As a result of his comparisons he concluded that these remains were not referable to any previously described genus and proposed *Microzeuglodon*. Abel[48] was so impressed by these differences that he erected a new family, Microzeuglodontidae, to include this form. At the same time he[49] remarked that there was considerable resemblance between *Zeuglodon caucasicus* Lydekker and the squalodonts *Neosqualodon assenzae* Dal Piaz and *Microsqualodon gastaldii* (Brandt). Abel remarks that so little is known concerning *Zeuglodon caucasicus* that its relationships with *Neosqualodon* can not be settled, and yet he considers there is sufficient data available for the erection of a new family for it. Both

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[43] Cope, E. D., Proc. Acad. Nat. Sci. Philadelphia [vol. 19], p. 151, 1867.

[44] Sjögren, H., Meddelanden fran Upsala Universitets Mineralogisk-Geologiska Institution, Stockholm vol. 13, fasc. 2–3, p. 4, 1891.

[45] Lydekker, R., Proc. Zool. Soc. London, pt. 4, No. 38, p. 559, 1893.

[46] Abel, O., Denkschr. Kais. Akad. Wiss. math.-naturw. Kl. Wien, vol. 90, p. 203, 1913.

[47] Stromer, E. von, Beiträge z. Paläont. u. Geol. Oester.-Ungarns u. d. Orients, Wien, vol. 15, p. 89 1903.

[48] Abel, O., Denkschr. Kais. Akad. Wiss. math.-naturw. Kl. Wien, vol. 90, p. 220, 1914.

[49] Abel, O., Idem, p. 207.

Neosqualodon and *Microzeuglodon* possess the same peculiar type of dentition and, in want of additional material, may be placed tentatively in the same limited group.

DELPHINODON ? DEBILIS (Leidy).

Phoca debilis LEIDY, J., Proc. Acad. Nat. Sci. Philadelphia, vol. 8, p. 265, 1856; Journ. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 7, p. 415, pl. 28, figs. 12, 13, 1869.

Type specimen.—Original description was based on three molar teeth, but one was withdrawn in 1869 and made the type of *Phoca modesta.* Types, Nos. 10324–10325, are in the Academy of Natural Sciences of Philadelphia.

Type locality.—Sands of Ashley River, South Carolina. Edisto marl or Upper Miocene.

Subsequent allocation.—This species was placed in the genus *Squalodon* by Cope.[50] The teeth as figured by Leidy do not bear any resemblance to the teeth of squalodonts, and they do not agree sufficiently with those of *Delphinodon* to be definitely referred to that genus. Even with allowance for variation, it seems probable to the writer that they represent some Miocene delphinid, as they are not suggestive of any known squalodont.

PATRIOCETUS DENGGI Abel.

Cetotheriopsis linziana BRANDT, J. F., Mem. Acad. Imp. Sci. de St.-Petersbourg, ser. 7, vol. 20, No. 1, pp. 42, 43–44, pl. 18, figs. 5*b*, 5*c*, 5*d*, 6*b*, 6*c*, 6*d*, 9*b*, 10*c*, 11*d* (lumbar vertebrae); pl. 18, figs. 5*e*, 5*f*, 5*g*, 6*e*, 6*f*, 6*g* (caudal vertebrae), 1873.

Patriocetus denggi ABEL, O., Denkschr. Kais. Akad. Wiss. math.-naturw. Kl. Wien, vol. 90, pp. 160, 194–199, text fig. 13, 1913.

Type specimen.—Based upon three lumbar and three caudal vertebrae. Types in the Museum Francisco-Carolinum at Linz, Austria.

Type locality.—Marine sand in the vicinity of Linz, in the valley of the Danube River, upper Austria. Upper Aquitanian or Upper Oligocene.

Subsequent allocation.—Although Abel tentatively proposes a new specific name for these vertebrae, he remarks that they may belong possibly to *Patriocetus ehrlichi* [=*Patriocetus grateloupii*]. In view of the number of types of cetacean skulls that are known from these marine sands, any allocation of isolated vertebrae will be subject to dispute.

SQUALODON EHRLICHII Van Beneden.

Squalodon ehrlichii VAN BENEDEN, P. J., Mém. Acad. Roy. Sci. Belgique, Bruxelles, vol. 35, pp. 50, 72, pl. 2, figs. 1–3, 1865.—BRANDT, J. F., Mém. Acad. Imp. Sci. de St.-Petersbourg, ser. 7, vol. 20, No. 1, pp. 323–326, pl. 31, figs. 1, 1*a*, 1*b*, 2, 1873.

Type specimen.—In his original description Van Beneden associated two distinct cetaceans under this name. His material included a skull with two squamosals, frontal, maxillae, premaxillae, ethmoid, and vomer; two molars in situ, and four double-rooted alveolae. Van Beneden, in addition to this skull, mentioned one premolar and two caniniform teeth. Besides the above material Van Beneden associated the skull of a supposed young individual[51] with this species. Types in the Museum Francisco-Carolinum at Linz, Austria.

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[50] Cope, E. D., Proc. Acad. Nat. Sci. Philadelphia [vol. 19], p. 144, 1867.

Type locality.—Found in a bed of marine sand in the vicinity of Linz, in the valley of the Danube River, upper Austria. Upper Aquitanian or Upper Oligocene..

Subsequent allocation.—The skull of the young individual was removed from this species by Brandt[52] and a new species, *Squalodon incertus* [=*Agriocetus incertus*=*Agriocetus austriacus* Abel] erected for it. The other skull is the supposed saurian of Klipstein and the same one that Von Meyer named *Squalodon grateloupii*. *Squalodon ehrlichii* of Van Beneden thus becomes a synonym of *Patriocetus grateloupii* (Meyer).

NEOSQUALODON GASTALDII (Brandt.)

Squalodon gastaldii ? Brandt, J. F., Mém. Acad. Imp. Sci. de St.-Petersbourg, ser. 7, vol. 20, No. 1, pp. 326–328, pl. 32, figs. 1–23, 1873.

Type specimen.—Consists of posterior portions of two mandibles, four serrate and two caniniform teeth, a cervical, a dorsal, three lumbar, and two caudal vertebrae, and a rib. Type in the collection of the University of Turin, Italy.

Type locality.—The "molasse" of Acquia, Piemonte, Italy. The nature of the deposit may have been given erroneously by Brandt, for Portis[53] states that the specimens came from a limestone formation near Acquia. Abel[54] considers that this formation belongs to the Middle Miocene. Aquitaniano or Upper Oligocene.

Subsequent allocation.—A new genus, *Microsqualodon*, was proposed for this species by Abel,[55] but he withdrew the name[56] on receiving additional information from Dal Piaz. Capellini[57] has reported on the discovery of additional remains of this interesting squalodont. His material includes a tympanic and a periotic.

TRIRHIZODON GERVAISII (Van Beneden.)

Squalodon gervaisii Van Beneden, P. J., Mém. Acad. Roy. Sci. Belgique, Bruxelles, vol. 35, p. 71, 1865.

Type specimen.—Name proposed for a single molar tooth figured by Gervais.[58] [An additional fragmentary molar crown is figured on pl. 8, figs. 12, 12*a*, and this was first described by Gervais [59] in 1846.] Type in the collection of the "Faculte des sciences de Montpellier," France.

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[51] Van Beneden, P. J., Mém. Acad. Roy. Sci. Belgique, Bruxelles, vol. 35, pl. 2, fig. 4; pl. 3, fig. 1.

[52] Brandt, J.F., Mém. Acad. Imp. Sci. de St.-Petersbourg, ser. 7, vol. 21, No. 6, pp. 39 (footnote), 42, 1874.

[53] Portis, A., Mémorie della Reale Accad. Sci. di Torino, ser. 2, vol. 37, pp. 329–333, 1886.

[54] Abel, O., Mém. Mus. Roy. Hist. Nat. Belgique, Bruxelles, vol. 3, p. 35, 1905.

[55] Idem., p. 35.

[56] Idem., p. 36.

[57] Capellini, G., Mém. Accad. Sci. dell'Ist. di Bologna, ser. 4, vol. 2, pp. 1-9, pl. –, figs. 1–7, 1881.

[58] Gervais, P., Zool. et Paléont. franç., Paris, ed. 1, vol. 1, p. 152, pl. 8, figs. 11, 11a, 1848-1852.

Type locality.—From the "molasse marine" of Saint-Jean-de-Védas, a locality west of Montpellier, Department of Herault, France. Helvetian or Middle Miocene.

Subsequent allocation.—Gervais states that this molar is three-rooted. His illustration shows that the crown of the tooth is imperfect and that the terminal portions of the roots are lost. The most characteristic feature of *Trirhizodon catulli* is the anterior cutting edge of the molariform teeth, and that portion of the tooth figured by Gervais is missing. Otherwise the specimen agrees well with Molin's form, taking into consideration the amount of variation to be expected among members of this group, the similarity of the steplike arrangement of the cusps on the posterior cutting edge, and the fact that the molar is of the three-rooted type.

SAUROCETUS GIBBESII Agassiz.

Sauro-cetus gibbesii AGASSIZ, L., Proc. Acad. Nat. Sci. Philadelphia, vol. 4, pp. 4–5, 1848.

Type specimen.—Based upon one imperfect tooth which "will easily be distinguished from the fang of *Dorudon*, by its great flatness and acute serrated edge." Type in the Museum of Comparative Zoology at Harvard College, Cambridge, Massachusetts.

Type locality.—Presumably from the Ashley River phosphate deposits of South Carolina.

Subsequent allocation.—There is a possibility that future discoveries may show the tooth upon which *Saurocetus* was based to be the same as *Colophonodon holmesii*. In that event this name of Agassiz would have priority over that proposed by Leidy.

SQUALODON GRATELOUPII AUTHORS (Not Von Meyer, 1843).

See *Delphinoides gratelupi* Pedroni [= *Squalodon typicus*, new species].

PATRIOCETUS GRATELOUPII (Meyer).

Squalodon grateloupii MEYER, H. von, Neues Jahrbuch für Mineralogie, Stuttgart, p. 704, 1843 [based upon "Sauriers (?)" of Klipstein [60]].—EHRLICH, C., Berichte Mittheil, Freund. naturwiss. in Wien, vol. 4, No. 2, pp. 197–199, and 4 text figs. on p. 199, 1848; Ueber die nordöstlichen Alpen, Bericht über das Museum Francisco-Carolinum, Linz, pp. 12–13, figs. *a*, *b*, *c*, 1850.

Squalodon ehrlichii VAN BENEDEN, P. J., Mém. Acad. Roy. Sci. Belgique, Bruxelles, vol. 35, pp. 50, 72, pl. 2, figs. 1–3, 1865.—BRANDT, J. F., Mém. Acad. Imp. Sci. de St.-Petersbourg, ser. 7, vol. 20, No. 1, pp. 323–326, pl. 31, figs. 1, 1*a*, 1*b*, 2, 1873.

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[59] Gervais, P., Ann. des Sci. Nat., Paris, ser. 3, vol. 5, p. 263, 1846.

[60] Klipstein, A. von, Archiv für Mineral. Geognosie, Bergbau und Hüttenkunde, Berlin, vol. 16, pt. 2, pp. 664–665, 1842.

Type specimen.—Consists of a somewhat damaged skull which possesses five cheek teeth in place, all two-rooted, but only two of which have their serrate crowns preserved. Type in the Museum Francisco-Carolinum at Linz, Austria.

Type locality.—Found in a deposit of marine sand in the vicinity of Linz, in the valley of the Danube River, upper Austria. These sands are now considered to be referable to the Upper Oligocene by Abel.[61] Upper Aquitanian or Upper Oligocene.

Subsequent allocation.—The genus *Squalodon* was established by Grateloup in 1840 for part of a left upper jaw with four serrate cheek teeth which he had obtained from the "grès marin" deposits of Leognan, Department of Gironde, France. This generic name was published without mention, by name of any species. A specific name *grateloupii* was first instituted in the genus *Squalodon* by Von Meyer in 1843.

Contrary to previously published statements, Meyer[62] did not base his *Squalodon grateloupii* upon the fragment of the jaw described as *Squalodon* by Grateloup.[63] He explicitly says that he proposes the name, *Squalodon grateloupii* for a cranial fragment from the Teritary sands in the vicinity of Linz which Klipstein[64] had described as the skull of a "Sauriers (?)," and Von Meyer further remarks that this specimen will be described shortly by Fitzinger. It was not, however, until 1848 that Carl Ehrlich,[65] instead of Fitzinger, figured the supposed saurian skull of Klipstein. The type is still extant at Linz, Austria.

As this was the first specific name to be applied in this genus it has been accepted as the type. However, as shown below, this skull from Linz does not belong to the same group of cetaceans as have hitherto been grouped under the name of *Squalodon*. Authors subsequent to Von Meyer, apparently, either ignored the original application of the specific term *grateloupii* or considered that the skull found near Linz and the rostral fragment from Léognan were identical. It appears that the first unquestionable application of the term *Squalodon grateloupii* to the Léognan specimen was that of Gervais.[66] The name was also used by the same writer for a serrate cheek-tooth[67] found near Saint-Jean-de-Védas, France.

To further complicate matters, this skull of Klipstein's formed in part the basis for *Squalodon ehrlichii* of Van Beneden. The latter, in his description of the supposed new species, *ehrlichii*, associated two distinct cetaceans under this name. Van Beneden's material included a skull with two squamosals, frontal, maxillae and premaxillae, ethmoid, and vomer; five cheek teeth are in place, all two-rooted, but only two have perfect crowns. This skull is the one that was mentioned by Klipstein. In addition to this skull, Van Beneden made reference to one premolar and two caniniform teeth and associated the skull of the supposed young squalodont[68] with this species. The skull of the young squalodont was removed from *Squalodon ehrlichii* by Brandt[69] and a new species, *Squalodon incertus* [=*Agriocetus incertus*=*Agriocetus austriacus* Abel], was erected for it.

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[61] Abel, O., Die Stamme der Wirbeltiere, Berlin und Leipzig, p. 757, expl. for fig. 566, 1919.

[62] Meyer, H. von, Neues Jahrbuch für Mineralogie, Stuttgart, p. 704, 1843.

[63] Grateloup, J. P. S., Actes Soc. Linn. de Bordeaux, vol. 11 for 1839, No. 56, p. 346, 1840; Actes Acad. Sci. Belles-lettres et Arts de Bordeaux, p. 201, 1840.

[64] Klipstein, A. von, Archiv für Mineral. Geognosie, Bergbau und Hüttenkunde, vol. 16, pt. 2, pp. 664–665, 1842.

[65] Ehrlich, C., Berichte über die Mittheil. von Freunden d. naturwiss. Wien, von Wilhelm Haidinger, vol. 4, No. 2, pp. 197–199, 4 text figs. on p. 199, 1848; Ueber die Nordöstlichen Alpen, Bericht über das Museum Francisco-Carolinum in Linz, vol. 11, p. 12, figs. *a*, *b*, *c*, on p. 13, 1850.

[66] Gervais, P., Zool. et Paléont. franç., Paris, ed. 1, vol. 1, p. 151, pl. 8, fig. 12, 1848–52.

[67] Gervais, P., Ann. Sci. Nat., Paris, ser. 3, vol. 5, p. 263, 1846.

In 1912, Abel[70] proposed a new genus *Patriocetus*, partly for the skull mentioned by Klipstein and partly for a well-preserved skull[71] found subsequently. Abel considered that the skull represented a precursor of the true whalebone whales and proposed to place it in a new family, the Patriocetidae. Winge[72] thought that perhaps *Patriocetus* might belong to the family Balaenidae, but it was not sufficiently represented by skeletal material to be definitely allocated.

Thus a specific name for Grateloup's *Squalodon* from Leognan, France, was never proposed by Von Meyer and he simply erred in his allocation of the Linz specimen to the genus *Squalodon*. Van Beneden[73] in revising the group applied the name *grateloupii* to Grateloup's specimen and redescribed Von Meyer's *Squalodon grateloupii* under the name of *Squalodon ehrlichii*. This action does not restrict the name *grateloupii* to Grateloup's specimen, for, as remarked above, Ehrlich had more than 15 years previously described and figured under the name *Squalodon grateloupii* the skull discussed by Klipstein and Von Meyer. In view of the above facts it is necessary to select another name for Grateloup's specimen which previously has been known as *Squalodon grateloupii*. For further discussion see remarks under *Delphinoides gratelupi* Pedroni.

DELPHINOIDES GRATELUPI Pedroni.

Delphinoides gratelupi PEDRONI, P. M., jr., Actes Soc. Linn. de Bordeaux, vol. 14, pp. 105–107 [pl. 1, figs. 2 and 3 do not accompany text in bound volume], 1845 [based upon *Squalodon* of Grateloup[74]].

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[68] Van Beneden, P. J. Mém. Acad. Roy. Sci. Belgique, Bruxelles, vol. 3., pl. 2, fig. 4, 1865.

[69] Brandt, J. F., Mém. Acad. Imp. Sci. de St.-Petersbourg, ser. 7, vol. 21, No. 6, pp. 39 (footnote), 42, 1874.

[70] Abel, O., Sitzungsber. math.-naturw. Kl. Kais. Akad. d. Wissenschaften, Wien, vol. 121, pt. 1, p. 69, 1912; Denkschr. d. Kais. Akad. Wissensch. math.-naturw. Kl., Wien, vol. 90, pp. 160, 194–199, text fig. 13, pls. 1, 2, 3; figs. 1–2, 4, pl. 1, 1913.

[71] König, A., Jahresb. Mus. Franc.-Carol., Linz, vol. 69, pp. 109–121, pl. 1, 1911; Stromer, E., Neues Jahrbuch für Mineralogie, Stuttgart, pp. 136–137, 1915.

[72] Winge, H., Vidensk. Medd. fra Dansk. naturh. Foren., vol. 70, 1918. Miller, G.S., Smithsonian Misc. Coll., Washington, D. C., vol. 72, No. 8, Publ. 2650, pp. 70, 71–72, 1921 (translation).

[73] Van Beneden, P. J., Mém. Acad. Roy. Sci. Belgique, Bruxelles, vol. 35, pp. 68–70, 1865.

[74] Grateloup, J. P. S., Actes Acad. Sci. Belles-lettres et Arts de Bordeaux, p. 201, 1840; see also Neues Jahrbuch für Mineralogie, Stuttgart pp. 830–832, 1841.

Squalodon grateloupii Gervais, P., Zool. et Paléont. franç., Paris, ed. 1, vol. 1, p. 151, pl. 41, fig. 5 [reversed], 1848–1852.—Van Beneden, P. J., and Gervais, P., Ostéographie des Cétacés vivants et fossiles, Paris, p. 430, Atlas, pl. 28, fig. 1, 1880.

Type specimen.—Based upon a basal section of the left side of the rostrum which possesses four serrate molors. Type was formerly in the private collection of Grateloup in Bordeaux, France.

Type locality.—Found at a depth of 13 or 14 meters in the quarry of Leognan, near Bordeaux, Department of Gironde, France. Mayencian[75] or Lowermost Middle Miocene.

Subsequent allocation.—Pedroni did not approve of the derivation of the name *Squalodon*, and proposed to replace it by *Delphinoides*. He redescribes Grateloup's specimen and applies the specific name *gratelupi* to it. The specific name *gratelupi* was instituted as a compliment to Grateloup and as such it should follow the same spelling as the name of the person in whose honor it was proposed. Hence *gratelupi* is an obvious misspelling or typographical error and is preoccupied by *Squalodon grateloupii* of Von Meyer.

The present uncertainty regarding the identity of the various imperfectly known squalodonts from the Miocene of France and elsewhere is largely the result of the description of new forms on specimens which do not permit comparison. A summary of what has been published concerning some of these specimens follows.

In addition to Grateloup's squalodont, Pedroni discussed two mandibles which he considered referable to *Delphinoides gratelupi*. Gervais[76] referred the right mandible,[77] from the sandstone of Leognan, to *Champsodelphis macrogenius*. This allocation has been questioned,[78] for *Delphinus macrogenius*, as applied by Laurillard,[79] was based upon a distal fragment of the combined lower jaws. It consists of a section about 3 inches in length from the symphysial region of the rami and possesses three teeth. The type specimen apparently represents a Miocene river dolphin. It appears that Laurillard was not the first to propose *Delphinus macrogenius*, as Von Meyer[80] used this name in the same conection five years previously. The general outlines and proportions of the mandible from Leognan recalls certain squalodonts, especially *Squalodon zitteli* and *Squalodon calvertensis*. The length of the symphysis, the proportions of the ramus, especially the width, and the large size of the anterior alveolae are features common to all three.

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[75] Deperet, C., Archiv Mus. d'Hist. Nat. de Lyon, vol. 4, p. 279, 1887.

[76] Gervais, P., Zool. et Paléont. franç., Paris, ed. 1, vol. 1, p. 152, pl. 41, figs. 7, 7*a* [reversed], 1848–1852.

[77] Pedroni, P. M., jr., Actes. Soc. Linn. Bordeaux, vol. 14, pp. 109–110, 1845.

[78] Fischer, P., Actes Soc. Linn. de Bordeaux, vol 27, livr. 1, p. 15, 1869.

[79] Laurillard, Dict. Univ. His. Nat., vol. 4, p. 684, 1846 [based upon "dauphin a longue symphyse"]; Cuvier, G., Recherches sur les Ossemens Fossiles, Paris, ed. 4, vol. 8, pt. 2, p. 160; Atlas, vol. 2, pl. 224, figs. 9, 10, 11, 1836.

[80] Meyer, H. von, Neues Jahrbuch für Mineralogie, Stuttgart, p. 327, 1841.

The other mandible mentioned by Pedroni[81] is less complete and belongs to the left side. An account of this specimen can be found under *Squalodon bordae*. The outlines of this mandible are quite unlike any squalodont thus far described, though at least one writer has recently held that it represents a valid species.

There is a third mandible[82] which should be mentioned in this connection. It was formerly in the private collection of Delfortrie and was obtained at Leognan, France. The angle and the condyle are well preserved. The coronoid is damaged on the posterior margin, and two serrate teeth are present in the ramus. No question has ever been raised regarding the relegation of this mandible to the squalodonts. It can hardly belong to the same specific form as either of the above mentioned mandibles from Leognan. The thinness of the horizontal ramus, the restriction of the symphysis to the inferior portion of the ramus, and the general appearance of the mandible as a whole suggest a distinct species.

A fourth specimen found in the "grès marin" at Leognan, France, and consisting of a nearly complete left mandible that possesses five serrate molar teeth was referred to *Squalodon grateloupi*[83] by Delfortrie. The illustration accompanying Delfortrie's article shows that the anterior edges of the second, third, and fourth two-rooted molariform teeth are provided with sawlike cutting surfaces and that the fifth and sixth are serrated by accessory cusps on both anterior and posterior edges. An alveolus for a seventh two-rooted tooth is present and is separated by an interval of 8 mm. from the alveolus for the sixth tooth. The mandible, as preserved, is 750 mm. in length and conforms in general proportions to that of *Squalodon calvertensis*. The horizontal ramus is deeper than that of the Maryland Squalodont. Delfortrie remarks that this mandible appears to have belonged to a *Squalodon* of larger size than those previously discovered at Leognan.

As the situation now stands the rostral fragment described by Grateloup remains without a valid name unless it can be shown that *Squalodon bordae* represents the same species. In view of the absence of an associated jaw and skull from the sandstone formation at Leognan, France, and the fact that at least two and possibly three types of squalodont mandibles are known from the Leognan deposits, it is advisable to propose the name, *Squalodon typicus*, new species, for the rostral fragment described by Grateloup as *Squalodon*. The allocation of the mandibles will best await future discoveries.

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[81] Pedroni, P. M., jr., Actes Soc. Linn. Bordeaux, vol. 14, pp. 107-109, 1845; Gervais, P., Zool. et Paléont. franç, Paris, ed. 1, vol. 1, p. 153, pl. 41, fig. 8 [reversed] 1848-1852.

[82] Fischer. P., Actes Soc. Linn. de Bordeaux, vol. 27, livr. 1, pp. 12-16, pl. 2, figs. 3*a*, 3*b*, 3*c*, 3*d*, 1869; Van Beneden, P. J., and Gervais, P., Ostéographie des Cétacés vivants et fossiles, Paris, p. 446, pl. 28, figs. 4, 4*a*, 1880.

[83] Delfortrie, E., Actes Soc. Linn. de Bordeaux, vol. 27, livr. 2, pp. 133-136, pl. 5, 1869.

METASQUALODON HARWOODI (Sanger).

Zeuglodon harwoodi SANGER E. B., Proc. Linn. Soc. New South Wales, Sydney, vol. 5, pt. 3, pp. 298–300, text figs., 1881.

Type specimen.—Based upon one molar and the fragments of a second.

Type locality.—Found in a bed of yellow calcareous clay near Wellington on the Murray River in South Australia. Sanger considered that these beds were Eocene in character. More recently, Hall[84] states that the formation which comprises the Murray River cliffs is generally regarded as Janjukian. The term Janjukian has also been applied to the Santa Cruz beds of Patagonia. Various writers have placed the age of these beds from Eocene to Miocene. Lower Miocene.

Subsequent allocation.—A new genus, *Metasqualodon,* was proposed for this species by Hall.[85] According to Abel[86] the *Zeuglodon harwoodi* of Sanger should be placed in the family Microzeuglodontidae and he tentatively cited the form as *Microzeuglodon? harwoodi.* At present this genus is too slightly known to offer any support for judgment of its relationships.

It still remains to be shown that Hall was right in allocating the tooth from Mount Gambier with Sanger's form. The ornamentation of the enamel crown suggests a closer relationship with *Parasqualodon wilkinsoni.* In that case this tooth represents one of the posterior premolars.

COLOPHONODON HOLMESII Leidy.

Colophonodon holmesii LEIDY, J., Proc. Acad. Nat. Sci. Philadelphia, vol. 6, p. 377, 1853.

Type specimen.—Represented by a nearly entire tooth, with fragments of five others. Type teeth possibly in the Academy of Natural Sciences at Philadelphia.

Type locality.—Sands of Ashley River, South Carolina. ? Edisto marl or Upper Miocene.

Subsequent allocation.—This species was referred to the genus *Squalodon* by Cope.[87] According to Leidy[88] these teeth are too small to be referred to either *Squalodon atlanticus* or *Squalodon antverpiensis,* and he suggests they may possibly bear a closer relationship with *Agorophius pygmaeus.* The remains are altogether too incomplete to propose any definite allocation in the light of our present knowledge of the fauna of these phosphate deposits.

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[84] Hall, T. S., Proc. Roy. Soc. Victoria (new ser.), Melbourne, vol. 23, pt. 2, art. 28, p. 263, 1911.

[85] Hall, T. S., Idem., p. 262, 1911.

[86] Abel, O., Denkschr. Kais. Akad. Wiss. math.-naturw. Kl. Wien, vol. 90, p. 220, 1913.

[87] Cope, E. D., Proc. Acad. Nat. Sci. Philadelphia [vol. 19], p. 153, 1867.

[88] Leidy, J., Journ. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 7, pp. 418–420, pl. 28, figs. 15–17, 1869.

SQUALODON HYPSISPONDYLUS Brandt.

Squalodon hypsispondylus ? BRANDT, J. F., Mém. Acad. Imp. Sci. de St.-Petersbourg, ser. 7, vol. 21, No. 6, p. 42, pl. 5, figs. 9–12, 1874.

Type specimen.—Species proposed provisionally for a caudal vertebra in the Museum Francisco-Carolinum at Linz, Austria.

Type locality.—No locality is given by Brandt. It is possible that the vertebra was collected by Ehrlich, and in that case it was probably found in the marine sand in the vicinity of Linz, in the valley of the Danube River, upper Austria. ? Upper Oligocene.

Subsequent allocation.—Additional material will be necessary before this species can be properly compared with other known forms.

AGRIOCETUS INCERTUS (Brandt).

Squalodon grateloupi MEYER, H. von, Neues Jahrbuch für Mineralogie, Stuttgart, p. 189, 1847 (part).

Squalodon ehrlichii BRANDT, J. F., Mém. Acad. Imp. Sci. de St.-Petersbourg, ser. 7, vol. 20, No. 1, p. 360, pl. 31, fig. 3, 1873.

Squalodon incertus ? BRANDT, J. F., Mém. Acad. Imp. Sci. de St.-Petersbourg, ser. 7, vol. 21, No. 6, pp. 39 (footnote), 42,, pl. 5, figs. 1–8, 1874.

Agriocetus austriacus ABEL, O., Denkschr. Kais. Akad. Wiss. math.-naturw. Kl. Wien, vol. 90, pp. 188–194, pl. 4, fig. 2; pl. 5, figs.1–2; pl. 7, 1913.

Type specimen.—Based on a posterior cranial fragment of a cetacean skull that was referred to *Squalodon ehrlichii* by Van Beneden.[89] A tympanic and a lumbar vertebra are also provisionally assigned to this new species. Type in the Museum Francisco-Carolinum at Linz, Austria.

Type locality.—Found in a bed of marine sand in the vicinity of Linz, in the valley of the Danube River, upper Austria. Upper Aquitanian or Upper Oligocene.

Subsequent allocation.—Abel[90] restricted the application of the name *incertus* to the tympanic and the lumbar vertebra and proposed the new genus and species, *Agriocetus austriacus*, for the skull. Brandt, however, based his name *Squalodon incertus* upon the cranial fragment described and figured by Van Beneden and only provisionally assigned the other skeletal material to the same species. Hence, the application of *incertus* could hardly be shifted from the type skull to other included material. According to the accepted rules of nomenclature the validity of the older name *incertus* was not impaired by this process of redefinition and should stand. *Agriocetus austriacus* Abel thus becomes a synonym of *Agriocetus incertus* (Brandt). Abel regards *Agriocetus* as a near relative of *Patriocetus*, and as an intermediate stage in the evolution of the true whalebone whales.

The characters which were assumed to be peculiar to the tympanic and the lumbar vertebra are not sufficiently diagnostic to show what relationship they may have to the other described forms. It is doubtful whether these specimens can be identified until more complete remains are found.

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[89] Van Beneden, P. J., Mém. Acad. Roy. Sci. Belgique, Bruxelles, vol. 35, pp. 72, 81, pl. 2, fig. 4, 1865.

[90] Abel, O., Denkschr. Kais. Akad. Wiss. math.-naturw. Kl. Wien, vol. 90, p. 189, 1913.

SQUALODON LINZIANUS Brandt.

Squalodon linzianus BRANDT, J. F., Bull. Acad. Imp. Sci. de St.-Petersbourg, vol. 16, p. 566, October, 1871; Bull. Acad. Imp. Sci. de St.-Petersbourg, Melanges Biol., vol. 8, p. 196, 1871; Mém. Acad. Imp. Sci. de St.-Petersbourg, ser. 7, vol. 20, No. 1, p. 47, 1873.

Type specimen.—Based upon a tympanic. Type in the Museum Francisco-Carolinum at Linz, Austria.

Type locality.—Marine sand in the vicinity of Linz, in the valley of the Danube River, upper Austria. Upper Aquitanian or Upper Oligocene.

Subsequent allocation.—Brandt's explanations are not always easily understood, for under his discussion of *Cetotheriopsis* he states that this tympanic may perhaps belong to *Squalodon linzianus*,[91] though further on he clearly states that it is referable to *Squalodon ehrlichii.*[92] Abel[93] refers this tympanic to his *Patriocetus ehrlichi* [=*Patriocetus grateloupii* (Meyer)].

CETOTHERIOPSIS LINTIANUS (Meyer).

Balaenodon lintianus MEYER, H. VON, Neues Jahrbuch für Mineralogie, Stuttgart, p. 550, 1849.

Stenodon lentianus VAN BENEDEN, P. J., Mém. Acad. Roy. Sci. Belgique, Bruxelles, vol. 35, pp. 73–79, pl. 4, and text figs. 2, 1865.

Type specimen.—The original description was based upon a posterior cranial fragment, an atlas and another large vertebra, a tympanic and a caniniform tooth. Von Meyer thought this tooth bore some resemblance to *Balaenodon* of Owen, and hence referred all of his material to that genus. The specimens are in the Museum Francisco-Carolinum at Linz, Austria.

Type locality.—Tertiary sands in the vicinity of Linz, in the valley of the Danube River, upper Austria. Upper Aquitanian or Upper Oligocene.

Subsequent allocation.—The year following the publication of the original description of *Balaenodon lintianus*, Meyer[94] apparently reconsidered his previously published statements and concluded he could not say positively that the tympanic and the tooth belonged to the genus *Balaenodon*. He also asserted that the cranial fragment showed more similarity to *Zeuglodon* than to *Squalodon*. The genus *Stenodon* of Van Beneden, like *Balaenodon lintianus* Meyer, was based upon a composite lot of specimens belonging to one or more unrelated cetaceans. The cranial fragment together with additional skeletal material formed the basis for the *Cetotheriopsis linziana* of

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[91] Brandt, J. F., Mém. Acad. Imp. Sci. de St.-Petersbourg, ser. 7, vol. 20, p. 46, 1873.

[92] Brandt, J. F., Idem, p. 333.

[93] Abel, O., Denkschr. Kais. Akad. Wiss. math.-naturw. Kl. Wien, vol. 90, p. 160, 1913.

[94] Meyer, H. von, Neues Jahrbuch für Mineralogie, Stuttgart, p. 205, 1850.

Brandt.[95] The tympanic[96] and the tooth[97] were referred to *Squalodon ehrlichii* by the same writer. Van Beneden,[98] also, considered that the tooth belonged to some squalodont.

Herluf Winge[99] has reviewed the history of these genera, and has pointed out that *Balaenodon lintianus* is the type of *Aulocetus* Van Beneden.[100] However, Van Beneden referred to this material by a vernacular name "Aulocete" in 1861, and the latinized form *Aulocetus*[1] dates from 1875. Hence the *Stenodon* of Van Beneden would thus have priority over the subsequently proposed *Cetotheriopsis linziana* Brandt, and *Aulocetus linzianum* Van Beneden. If we accept the ruling that *Stenodon* is preoccupied by *Steneodon*,[2] then *Cetotheriopsis* becomes the next available name. This form represents a whalebone whale and is included here only because of Von Meyer's remarks.

CETERHINOPS LONGIFRONS Leidy.

Ceterhinops longifrons LEIDY, J., Journ. Acad. Nat. Sci. Philadelphia, vol. 8, pp. 230–232, pl. 34, fig. 7, 1877.

Type specimen.—Consists of a fragment of a skull, comprising portions of the "frontal, ethmoid, vomer, maxillaries, and intermaxillaries, all intimately coossified." Type, No. 11420, Academy of Natural Sciences of Philadelphia.

Type locality.—Ashley River phosphate beds, South Carolina. Edisto marl or Upper Miocene.

Subsequent allocation.—This cranial fragment, composed chiefly of the bones surrounding the nasal passages, resembles *Eurhinodelphis* so closely that there appears no valid reason for separating this form from the latter genus. As remarked by Leidy the mesethmoid forms a thick partition separating the nasal passages and terminating anteriorly at the commencement of the mesorostral channel. The presence of a second pair of openings leading into the brain case and originating at the posterior end of the mesethmoid channel is shown by Leidy's figure. For the present, and in absence of a more complete skull, its exact specific allocation will best await further explorations in these deposits. The characters of this fragment, so far as they go, agree well with those of other *Ceterhinops* skulls from the Ashley River phosphate deposits and to a less extent with those of *Arionius servatus*.

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[95] Brandt, J. F., Mém. Acad. Imp. Sci. de St. Petersbourg, ser. 7, vol. 20, No. 1, p. 40, pl. 19, figs. 1–4, 1873; vol. 21, No. 6, pp. 6–11, pl. 1, figs. 1–16, 1874.

[96] Brandt, J. F., Idem, pp. 42, 45–46, 333, pl. 31, figs. 4, 5.

[97] Brandt, J. F., Idem, pp. 38, 42, 324, 333, pl. 31, figs. 10, 10*a*.

[98] Van Beneden, P. J., Mém. Acad. Roy. Sci. Belgique, Bruxelles, vol. 35, pp. 76–77, text fig. 76, 1865.

[99] Winge, H., Vidensk. Medd. fra Dansk. naturh. Foren. Kjøbenhavn, pp. 17–18, 19, 1909.

[100] Van Beneden, P. J., Bull. Acad. Roy. Sci. Belgique, Bruxelles, ser. 2, vol. 12, p. 480, 1861.

[1] Van Beneden, P. J., Idem, vol. 40, pp. 537-539, 1875.

[2] Croizet, Revue Encyclopédique, vol. 59, p. 86 (footnote), July–September, 1833.

So far as known, no squalodont skull possesses a small canal, opening near the center of the concave horizontal plate of the maxilla and approximately in line with the posterior margins of the nasal passages, which connects with the infraorbital system. Such a canal is present on the right edge of the fragment and is plainly indicated in Leidy's figure. Canals in a corresponding position are to be found in crania belonging to Yale University and obtained from the same deposits.

SQUALODON MELITENIS (Blainville).

Phoca ? melitensis antiqua and *P(hoca) dubia melitensis* BLAINVILLE, H. M. D., Ostéographie ou description iconographique, Paris, vol. 2, livr. 7, pp. 46, 51; Atlas, vol. 2, pl. 10, fig. 4, 1840.[3] [Based upon the description of Scilla.[4]]

Phoca ? melitensis antiqua MEYER, H. von, Neues Jahrbuch für Mineralogie, Stuttgart, p. 242, 1841.

Phocodon scillae AGASSIZ, L., Valentine's Repertorium Anat. et Physiol. Bern and St. Gallen, vol. 6, p. 236, 1841 [based upon the type specimen].

Squalodon melitensis McCOY, F., Geol. Mag. London, vol. 4, No. 34, p. 145, 1867.

Squalodon melitensis (Meyer MSS) BRANDT, J. F., Mém. Acad. Imp. Sci. de St.-Petersbourg, ser. 7, vol. 20, No. 1, p. 330, 1873.

Type specimen.—Consists of a fragment of the mandible with three teeth in situ. Type in Cambridge University Museum, England.

Type locality.—The tufa of Malta.[5] Burdigalian or Lower Miocene.

Subsequent allocation.—This interesting specimen has been the subject of much controversy, and at various times has been placed with the pinnipeds, squalodonts, and zeuglodonts. Müller[6] came to the conclusion that it represented a zeuglodont, for he says: "Ueber die generische Identität des *Zeuglodon* und der Zähne bei Scilla, hegte ich Keinen Zweifel."

SQUALODON MEYERI Brandt.

Squalodon meyeri BRANDT, J. F., Mém. Acad. Imp. Sci. de St.-Petersbourg, ser. 7, vol. 20, No. 1, pp. 316–318, 1873; vol. 21, No. 6, pp. 29–30, 54, pl. 4, figs. 18–19 [outline drawings of molars], 1874 [based upon the following: *Arionius servatus* Meyer[7] and "Viertes Cetaceum der Molasse" of Jäger[8]].

Type specimen.—A poorly preserved rostral fragment obtained from Professor Schübler formed the basis of Jäger's remarks. Another incomplete skull became the type of *Arionius servatus* Meyer. Brandt, apparently, made this last-mentioned specimen the type of his *Squa-*

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[3] Sherborn, C. D., Ann. Mag. Nat. Hist. London, ser. 7, vol. 2, No. 7, p. 76, July, 1898. [Gives date of publication for livr. 7.]

[4] Scilla, A., De Corporibus marinis lapidescentibus, Rome, p. 47, pl. 12, fig. 1, 1747.

[5] Scilla, A., De Corporibus marinis lapidescentibus, Rome, explan. for pl. 12, 1759; and Longhi, P., Atti della Soc. Veneto-Trentina di Sci. Nat. resid. in Padova, ser. 2, vol. 3, fasc. 1, p. 48, 1897; Fuchs, Th., Das Alter der Tertiärschichten von Malta, Sitzungsber. math.-naturw. Cl. Akad. Wiss., Wien, vol. 70, Abt. 1, pp. 98–100, 1875 (Aquitanien); Haug, E., Traité de Geologie, Pt. 2, Les Periodes Géologiques, Paris, p. 1647, 1908–1911 (Burdigalien).

[6] Müller, J., Ueber die fossilen Reste der Zeuglodonten von Nordamerica, Berlin, p.—, 1849.

[7] Meyer, H. von, Neues Jahrbuch für Mineralogie, Stuttgart, p. 315, 1841.

[8] Jäger, G. F., Ueber die fossilen Säugethiere welche in Wurtemberg aufgefunden worden sind, Stuttgart, pt. 1, p. 7 [specimen No. 21], pl. 1, fig. 28, 1835, and pt. 2, pp. 200, 213, 1839; Jäger, G. F., Nova Acta Acad. Caes. Leop., vol. 22, pt. 2, p. 780, 1850.

lodon meyeri.[9] Type in the "Württemb. Naturalien Sammlung" at Stuttgart, Germany.

Type locality.—Both specimens came from the "Molasse bei Baltringen," Wurttemberg, Germany. The "Meeresmolasse" of Baltringen is referable to the Middle Miocene or Vindobonian according to Osborn.[10]

Subsequent allocation.—Trouessart[11] placed this species in the synonymy of *Squalodon servatus.* The species should be considered as a substitute name for *Arionius servatus* Meyer, for Brandt held this genus was without foundation and that the species properly belonged in the genus *Squalodon.*

PACHYODON MIRABILIS Meyer.

Pachyodon mirabilis MEYER, H. von, Neues Jahrbuch für Mineralogie, Stuttgart, p. 414, 1838.

Type specimen.—Original description was based upon a single tooth which was thought to bear resemblance to some pinniped. Type probably in the "Württemb. Naturalien Sammlung" at Stuttgart, Germany.

Type locality.—Type tooth came from the "Bohnerz-Ablagerungen" of Altstadt near Mösskirch in Baden, Germany.[12] Middle Miocene.

Subsequent allocation.—Von Meyer describes this tooth in such a perfunctory manner that it should be considered unidentifiable. He says that it belongs to a phocid like animal, and so far as known to the writer, never published a figure of the specimen. A few years later, Von Meyer[13] referred two molar teeth obtained from the "Bohnerz" formation of Mösskirch or Heudorf to this form. In 1847, he published a more detailed description[14] of the teeth from Mösskirch and Baltringen. From this account it appears that the molar teeth of *Pachyodon* are serrated on one edge only and three or four distinct accessory cusps are usually present. The roots of the molars are united by a thin isthmus and the crown is high in comparison with that of *Zeuglodon.* From what has been published concerning this material, it is not possible to clear up the relationship it may have to the other described squalodonts.

Brandt[15] has raised the question whether Von Meyer's *Pachyodon* has priority over Grateloup's *Squalodon.* The name *Pachyodon* should not be revived in this sense until we can be certain that Von Meyer's specimen really pertains to those cetaceans we now recognize as *Squalodon* and not some other cetacean.

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[9] Brandt, J. F., Mém. Acad. Imp. Sci. de St.-Petersbourg, ser. 7, vol. 20, No. 1, p. vii, 1873; and vol. 21, No. 6, pp. 30, 37, 1874.

[10] Osborn, H. F., The Age of Mammals, New York, p. 258, 1910.

[11] Trouessart, E. L., Cat. Mamm. viv. foss., Berlin, fasc. 5, p. 1011, 1898.

[12] Bronn, H. G., Lethaea Geognostica, Stuttgart, vol. 3, pp. 754, 755, 1856.

[13] Meyer, H. von, Neues Jahrbuch für Mineralogie, Stuttgart, pp. 459, 460, 1841.

[14] Meyer, H. von, Idem, p. 673, 1847.

[15] Brandt, J. F., Mém. Acad. Imp. Sci. de St.-Petersbourg, ser. 7, vol. 20, No. 1, p. 315, 1873.

PHOCA ? MODESTA Leidy.

Phoca modesta Leidy, J., Journ. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 7, p. 415, pl. 28, fig. 14, 1869.

Squalodon ? modestus Hay, O. P., Bull. No. 179, U. S. Geol. Surv., Department of the Interior, Washington, D. C., p. 589, 1902.

Type specimen.—Original description was based upon one small tooth which was thought to bear resemblance to some phocid. This tooth is also one of the three teeth which formed the basis for *Delphinodon ? debilis* (Leidy). Type, No. 10323, the Academy of Natural Sciences of Philadelphia.

Type locality.—The Ashley River phoshate deposits of South Carolina. Edisto marl or Upper Miocene.

Subsequent allocation.—Leidy refers this tooth to the genus *Phoca*, though he qualified his allocation with the statement that "it is not improbable it may belong to a squalodont." Allen[16] concurs with this assumption. It seems more likely, from what is now known concerning the various described species of *Squalodon* and other Miocene cetaceans, that this tooth belongs to some pinniped.

SQUALODON MOLASSICUS (Bronn).

Delphinus molassicus Bronn, H. G., Neues Jahrbuch für Mineralogie, Stuttgart, p. 732, 1837 [based upon "Delphin," specimen No. 21 of Jäger[17]]

[*Squalodon*] ? *molassicus* Trouessart, E. L., Cat. Mamm. viv. foss., Berlin, fasc. 5, p. 1011, 1898.

Type specimen.—Based upon a posterior fragment of the rostrum with alveolae; the tip of rostrum and brain case are wanting.

Type locality.—Stone pit of Baltringen near Biberach, Wurttemberg, Germany. Vindobonian or Middle Miocene.

Subsequent allocation.—See remarks under *Arionius servatus*.

KEKENODON ONAMATA Hector.

Kekenodon onamata Hector, J., Trans. and Proc. New Zealand Institute for 1880, Wellington, vol. 13, pp. 435–436, pl. 18, 1881.

Type specimen.—Consists of fragments of the lower jaw and some 10 teeth, including 5 cheek teeth, 1 of which is three-rooted, and 2 canines, a tympanic and a periotic. Type, Cat. No. Ma. 69, the Dominion Museum at Wellington, New Zealand.

Type locality.—The specimens were obtained by McKay of the Geological Survey "from the Upper Eocene strata of the Waitaki Valley in Otago," New Zealand. The investigations of James Park[18] have yielded much information which is new concerning the occurrence of *Kekenodon* in New Zealand. He pointed out that *Kekenodon* occurs in soft calcareous sandstone or shelly sands, often glauconitic, and that these strata belong to the Oamaru system. The invertebrate fauna led Professor Park to advance the opinion that the *Kekenodon* horizon is not older than the Middle Miocene. According to this investigator, *Kekenodon* always occurs in the same horizon, and its vertical range is very limited. Furthermore, the *Kekenodon* bone bed always occurs at the base of the Waitaki or Ngapara stone and thus belongs to the Lower Hutchinsonian or Upper Ototaran stage. Dr. J. Allan Thomson[19] employs the stage names Upper Wairekan or Lower Ototaran for the *Kekenodon* bone beds. Oamaru system, Oligocene or Lower Miocene.

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[16] Allen, J. A., Misc. Publ. No. 12., U. S. Geol. Geogr. Surv. Terr., Dept. Interior, Washington, D. C., p. 474, 1880.

[17] Jäger, G. F., Ueber die fossilen Säugethiere, welche in Würtemberg aufgefunden worden sind, Stuttgart, pt. 1, p. 7, pl. 1, fig. 28, 1835; and pt. 2, pp. 200, 213, 1839.

[18] Park, J., Trans. and Proc. New Zealand Institute for 1904, Wellington, vol. 37 [n. s., vol. 20], pp. 511, 522, 523, 525, 529, 540 551, June, 1905.

Subsequent allocation.—This genus was referred to the Squalodontidae by Hall,[20] but there is some reason for doubt regarding this allocation. The remarkably strong resemblance which these teeth bear to those of *Dorudon serratus* as represented by teeth in the collection of Yale University implies a close relationship. The unusual appearance of the accessory cusps, the character of the enamel surface of the crown, and the large size of the teeth are peculiarities which place this form among the zeuglodonts. Such features are unknown for any squalodont.

According to Park,[21] remains of *Kekenodon onamata* have been collected at the following localities: Shelly sands and soft sandstones [loose calcareous greensand = *Kekenodon* beds] exposed on the south bank of the Waitaki River, one half a mile below the junction of the Wharekuri Stream; glauconitic greensands [Marawhenua greensand] at the base of Waitaki Stone, a mile and a half east of Marawhenua; marly greensands [Upper Waihao greensand] immediately underlying the Waitaki Stone at Waihao Forks; as well as from the Kakanui greensand on the seacoast near Kakanui Township.

An interesting discovery of supposed *Zeuglodon* vertebrae on Seymour Island has recently been reported by Wiman.[22] All that is known of this form are two imperfect caudal vertebrae. There is a possibility that these vertebrae belong to a form related to *Kekenodon.*

ARCHAEODELPHIS PATRIUS Allen.

Archaeodelphis patrius ALLEN, G. M., Bull. Mus. Comp. Zool. at Harvard College, Cambridge, vol. 65, No. 1, pp. 1–14, pl., figs. 1–2, text figs. 1–3, August, 1921.

Type specimen.—"A cranium, lacking the bones of the vertex, the jugals, the teeth, and all but the nasal portion of the rostrum."

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[19] Thomson, J. Allan, The Notocene geology of the middle Waipara and Weka Pass district, North Canterbury, New Zealand. Trans. and Proc. New Zealand Institute, Wellington, vol. 52, p. 323, 1920; Vaughan, T. W., Proc. First Pan-Pacific Sci. Conference held under auspices of Pan-Pacific Union, Special Publ. No. 7, pt. 3, pp. 722, 726, 731, table opposite p. 732, Bishop Museum, Honolulu, Hawaii, 1922.

[20] Hall, T. S., Proc. Roy. Soc. Victoria, Melbourne (n. s.), vol. 23, pt. 2, art. 23, p. 258, 1911.

[21] Park, J., Trans. and Proc. New Zealand Institute for 1904, vol. 37, pp. 509, 522, 523, 525, 529.

[22] Wiman, C., Wissenschaftliche Ergebnisse der Schwedischen Südpolar-Expedition 1901–1903, Stockholm, vol. 3, pp. 3-6, pl. 1, figs. 1–4, 1916.

Type, No. 15749, Museum of Comparative Zoology, Cambridge, Massachusetts.

Type locality.—Not known. The foraminifera in the surrounding matrix indicate that it was probably derived from the Jackson formation of the Upper Eocene of the southeastern United States, possibly Alabama. There is a possibility, however, that this may be the second skull found by F. S. Holmes[23] in the Ashley River region of South Carolina. Upper Eocene.

Subsequent allocation.—The long forward sloping nasal passages, the elongate flattened nasals, parietals forming part of the vertex, as well as other features, led Allen to place this form in the family Agorophiidae. Teeth, alone, are lacking to fully corroborate this allocation. So far as can be ascertained from a study of the figures and description of *Archaeodelphis patrius* and those of True[24] for *Agorophius pygmaeus* it appears that Allen was justified in stating that "its relationship is perhaps nearer to *Agorophius*" than to *Prosqualodon.*

SQUALODON ? PELAGIUS Leidy.

Squalodon pelagius Leidy, J., Journ. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 7, p. 420, pl. 29, fig. 1, 1869.

Type specimen.—Consists of a fragment of the left maxilla with one double-rooted molar in situ. Type in the Academy of Natural Sciences at Philadelphia.

Type locality.—From Ashley River, near Charleston, South Carolina. Edisto marl or Upper Miocene.

Subsequent allocation.—The relationships of this specimen are very uncertain according to Leidy and he expressed some doubt as to whether it should be referred to a squalodont.

CYNORCA PROTERVA Cope.

Squalodon protervus Cope, E. D., Proc. Acad. Nat. Sci. Philadelphia [vol. 19], p. 151, 1867.

Type specimen.—Consists of a single canine tooth. Type in the Academy of Natural Sciences at Philadelphia.

Type locality.—Not stated in the original description. It is given as Charles County, Maryland, by Leidy.[25] Calvert or Upper Miocene.

Subsequent allocation.—Cope[26] thought the peculiar appearance of this tooth warranted the establishment of a new genus, *Cynorca,* for it. Leidy[27] was of the opinion that the type tooth of this supposed squalodont belonged to some peccary, and that the two other teeth[28] mentioned by Cope might be the same as that described as *Squalodon*

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[23] Tuomey, M., Report of the Geology of South Carolina, Columbia, p. 166, 1848.

[24] True, F. W., Remarks on the type of the fossil cetacean *Agorophius pygmaeus* (Müller), Publ. 1694, Smithsonian Institution, p. 7, 1907.

[25] Leidy, J., Journ. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 7, p. 385, 1869.

[26] Cope, E. D., Proc. Acad. Nat. Sci. Philadelphia, [vol. 19], p. 152.

[27] Leidy, J., Journ. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 7, pp. 384–385.

[28] Leidy, J., Idem., p. 423.

pelagius. The tooth mentioned above was clearly designated as the type by Cope, and since it was originally described as a species of the genus *Squalodon*, it invalidates any subsequent use of this specific name in this genus. There are four teeth, however, labeled with this name, from Ashley River, South Carolina, in the Academy of Natural Sciences of Philadelphia. Two of these teeth are figured by Leidy[29] and described under the name of *Squalodon protervus*. Whatever the determination of this last mentioned material may eventually prove to be, it is evident that the use of the specific name *protervus* in this sense is invalid.

AGOROPHIUS PYGMAEUS (Müller).

Zeuglodon pygmaeus MÜLLER, J., Ueber die fossilen Reste der Zeuglodonten von Nordamerica, Berlin, p. 29, pl. 23, figs. 1, 2, 1849.

Squalodon pygmaeus LEIDY, J., Journ. Acad. Nat. Sci. Philadelphia, ser 2, vol. 7, p. 420, pl. 29, figs. 7, 8, 1869.

Type specimen.—Consists of an imperfect skull and one serrate molar tooth. Formerly in the private collection of F. S. Holmes and now appears to have been lost.

Type locality.—Eocene marl at Greer's Landing on the Ashley River, about 10 miles from Charleston, South Carolina. These beds of soft limestone along the Ashley River are known as the Ashley-Cooper marl, and are referable to the Jackson group according to Willis.[30] Upper Eocene.

Subsequent allocation.—The original publication on the discovery of this specimen[31] attracted the attention of J. Müller, who was at that time engaged in a revision of the zeuglodonts, and a description and figure of the specimen appeared in his work under the name of *Zeuglodon pygmaeus*. During the preceding year, Tuomey,[32] State geologist of South Carolina, published some additional information regarding this cetacean. He remarked:

> The first intimation of this strange cetacean, on the Ashley, I owe to Mr. F. S. Holmes, who sent me a portion of the upper jaw, with one perfect tooth in its proper socket; and although it differed in size and in other respects from all the specimens hitherto discovered, its *Zeuglodon* characteristics were quite evident, and, with the rest of the skull (afterwards found by Prof. L. R. Gibbes), added very materially to our knowledge of the true affinities of this cetacean. Other bones, and among them a perfect scapula and another skull, have since been found by Mr. Holmes.

In 1895, Cope[33] proposed a new generic name, *Agorophius*, for this specimen and concluded that it was generically distinct from *Squalodon* and *Dorudon*. He remarks: "The form of the skull in this genus approaches distinctly that of *Cetotherium* of the Balaenidae, and the permanent loss of the teeth would probably render it necessary to refer it to a Mystacocete." True[34] has reviewed the history of this interesting specimen and suggests that: "The large extension of the parietals on the superior surface of the skull in *Agorophius* indicates that it is a primitive form and it is not unlikely that some such form was the ancestor of both *S. ehrlichii* [=*Patriocetus grateloupii*] and typical *Squalodon*. That *Agorophius* itself is in the direct line is improbable on account of the form of the teeth." Abel[35] erects a new family Agorophiidae to include *Agorophius* and *Prosqualodon*, and considers this family as ancestral to the true squalodonts.

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[29] Leidy, J., Journ. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 7, pl. 28, figs. 18 and 19.

[30] Willis, B., Prof. Paper No. 71, U. S. Geol. Surv., Washington, D. C., p. 739, 1912.

[31] Tuomey, M., Proc. Acad. Nat. Sci. Philadelphia, vol. 3, pp. 151-153, 1847; Journ. Acad. Nat. Sci. Philadelphia, vol. 1, pp. 16-17, 1847.

[32] Tuomey, M., Report of the geology of South Carolina, Columbia, p. 166, 1848.

[33] Cope, E. D., Proc. Amer. Philos. Soc., vol. 34, No. 147, p. 139, 1895.

SQUALODON QUATERNARIUM Forsyth-Major.

Squalodon quaternarium Forsyth-Major, C. J., Atti della Soc. Toscana di Sci. Nat. residente in Pisa (Processi Verbali), vol. 2, p. 227, 1881.

Type.—Original brief description was based upon a single tooth that was found associated with the remains of a number of Quaternary mammals, including "*Rhinoceros hemitechus*, *Elephus antiquus*, and *Ursus spelaeus*."

Type locality.—Found in the "breccia ossifera di Montetignoso," near Livorno, Italy. Quaternary ?.

Subsequent allocation.—This specimen is mentioned by Portis[36] and he, apparently, believed the tooth presented characters that would distinguish it from previously described forms. Forsyth-Major failed to give an intelligible description for this tooth and hence the name *quaternarium* has no standing.

PHOCA ? RUGIDENS Meyer.

Phoca ? rugidens Meyer, H. von, Neues Jahrbuch für Mineralogie, Stuttgart, p. 309, 1845.

Type specimen.—"Zähne von einem *Phoca*-artigen Thier, das ich *Phoca ? rugidens* nenne."

Type locality.—Neudorfl on the March River near Pressburg, Hungary. Middle Miocene.

Subsequent allocation.—In discussing this tooth, Von Meyer[37] states that it is smaller and possesses fewer accessory cusps than those of *Phoca* [=*Microcetus*] *ambigua* and that the cusps do not extend up the sides of the main cone. He concludes that the type tooth exhibits a closer relationship with the genus *Phoca* than with *Squalodon* or *Zeuglodon*.

This species was placed provisionally in the genus *Pristiphoca* by Trouessart.[38] It is possible that this tooth may belong to a pinniped and not to a cetacean. At present this form is too imperfectly known to be discussed, and if the type is still in existence it will need to be restudied and figured to show whether Meyer was right or not.

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[34] True, F. W., Remarks on the type of the fossil cetacean *Agorophius pygmaeus* (Müller), Publ. 1694, Smithsonian Institution, p. 7, 1907.

[35] Abel, O., Denkschr. Kais. Akad. Wiss. math-naturw. Kl. Wien, vol. 90, p. 220, 1913.

[36] Portis, A., Mémorie della Reale Accad. delle Sci. di Torino, ser. 2, vol. 37, p. 333, 1886.

[37] Meyer, H. von, Neues Jahrbuch für Mineralogie, Stuttgart, p. 674. 1847.

[38] Trouessart, E. L., Cat. Mamm. viv. foss., Berlin, fasc. 2, p. 380, 1897.

PHOCODON SCILLAE Agassiz.

See *Squalodon melitensis* (Blainville).

SQUALODON SERRATUS Davis.

Squalodon serratus DAVIS, J. W., Sci. Trans. Roy. Dublin Soc., ser. 2, vol. 4, pp. 46–48, pl. 7, fig. 9, 1888.—HALL, T. S., Proc. Roy. Soc. Victoria (n. s.), vol. 23, pt. 2, art. 23, p. 258, 1911.

Type specimen.—Consists of a single tooth enveloped in a matrix of light-colored calcareous sandstone. "The crown only is exposed and consists of a number of cones, of which six are visible, having obtusely pointed apices." Type in the Canterbury Museum, Christchurch, New Zealand.

Type locality.—"White Rock River Quarry," New Zealand. There is some uncertainty about this locality. According to the Geological Survey Department of New Zealand it is not White Rock River, Pareora, but probably "White Rock" Quarries, Okuku River, North Canterbury.[39] This squalodont should be referred to the Ototaran stage. Oamaru system; Oligocene or Lower Miocene.

Subsequent allocation.—Hall states that he "would doubtfully place this form under the synonymy of Sanger's species" *Metasqualodon harwoodi.*

ARIONIUS SERVATUS Meyer.

Arionius servatus MEYER, H. von, Neues Jahrbuch für Mineralogie, Stuttgart, pp. 315–331, 1841; Palaeontographica, Cassel, vol. 6, pp. 31–43, pl. 6, figs. 1–9, 1856-1858.

Type specimen.—Consists of an incomplete skull which was partially embedded in a large block of sandstone. The symphysial portion of the lower jaws, conical teeth, and other bones were also preserved in this slab. Type in the "Württemb. Naturalien Sammlung" at Stuttgart, Germany.

Type locality.—Sandstone formation of Baltringen, near Biberach, Württemberg, Germany. Vindobonian or Middle Miocene.

Subsequent allocation.—Van Beneden[40] referred this form to the genus *Squalodon.* If *Delphinus molassicus* of Bronn[41] belongs to the same species as the skull upon which *Arionius servatus* Meyer was based, then this last mentioned species will stand as a synonym of *Squalodon molassicus* (Bronn). This allocation is open to question, for Schübler's rostral fragment is so imperfect that actual comparison of the two specimens would be necessary to decide their relationship.

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[39] Hector, J., New Zealand Geol. Surv. Report, vol. 22, p. 119, 1894; Morgan, P. G., New Zealand Geol. Surv., Paleont. Bull. No. 7, p. 37, 1918.

[40] Van Beneden, P. J., Ostéographie des Cétacés, Paris, pp. 438-439; Atlas, pl. 28, figs. 22-24, 1880.

[41] Bronn, H. G., Neues Jahrbuch für Mineralogie, Stuttgart, p. 732, 1837.

The alveolae of this rostral fragment as figured by Jaeger[42] are essentially the same as those found in the skulls of true squalodonts. Joseph Probst[43] has suggested that the teeth discussed by Van Beneden[44] under the name of *Squalodon servatum*, belong to *Squalodon catulli*. However, Probst drew his conclusions from the rostral fragment, with teeth in situ, described and figured by De Zigno[45] under the name of *Squalodon catulli*.

The anterior end of the presphenoid is exposed and forms a plug across the proximal end of the mesorostral channel in the skull of *Squalodon calvertensis*. If Lortet's figure of *Squalodon bariensis* and Von Meyer's figure of *Arionius servatus* are correct, the mesethmoid in these forms a partition separating the nasal passages externally and diminishes in thickness anteriorly, presumably sheathing the vomer for a short distance forward. At any event there is no indication of the presence a presphenoid plug at the proximal end of the mesorostral channel.

According to Probst[46] the type skull of *Arionius servatus* possesses alveolae unlike those found in the skulls of other squalodonts. In this article he compares the teeth found near Baltringen with the teeth of *Squalodon zitteli* from Bleichenbach-sur-Rott, Bavaria, but concludes they show more relationship to the Italian specimens. It still remains to be shown that there are two species of squalodonts in the sandstone formation in the vicinity of Baltringen.

PHYSOTHERIUM SOTTERII Portis.

Physotherium sotterii PORTIS, A., Mémorie della Reale Accad. delle Sci. di Torino, ser. 2, vol. 37, pp. 325–326, pl. 7, figs. 91–94, 1886.

Type specimen.—Original description based upon a fragment of a jaw, with four teeth in situ. Type probably in the collection of the University of Turin, Italy.

Type locality.—From the marine deposits "dell'Astigiana," probably in the valley of the Andona River, Italy. Astiano[47] or Upper Pliocene.

Subsequent allocation.—This species is based upon such poor material that accurate determination or comparison with the other described forms is impossible. Abel[48] states that this genus does not belong in the Physeteridae, as is shown by the base of the crown and the rapid narrowing of the roots.

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[42] Jäger, G. F., Ueber die fossilen Säugethiere, welche in Würtemberg aufgefunden worden sind, Stuttgart, pt. 1, pl. 1, fig. 28, 1835.

[43] Probst, J., Jahreshefte des Vereins für vaterl. Naturkunde in Württemberg, vol. 47, pp. 49-67, pl. 1, 1885.

[44] Van Beneden, P. J., Bull. Acad. Roy. Sci. des Lettres et des Beaux-Arts, Bruxelles, ser. 2, vol. 41, No. 3, p. 474, pl.—, figs. 4–5, 7–9, 1876.

[45] Zigno, A. de, Mém. R. Istituto Veneto di Scienze, Lettere et Arti, Venezia, vol. 20, pp. 8–13. pl.—, figs. 1–3, 1876.

[46] Probst, J. Jahreshefte des Vereins für vaterl. Naturkunde in Württemberg, vol. 47, pp. 52, 53, 1885.

[47] Sacco, F, Catalogo Paleontologico del Bacino Terziario del Piemonte, Boll. della Soc. geol. Italiana, vol. 8, fasc. 3, p. 191, 1890.

[48] Abel, O., Mém. Mus. Roy. Hist. Nat. Belgique, Bruxelles, vol. 3, p. 53, 1905.

TRIRHIZODON SUESSII Brandt.

? *Squalodon suessii* Brandt, J. F., Mém. Acad. Imp. Sci. de St.-Petersbourg, ser. 7, vol. 20, No. 1, p. 330, pl. 32, figs. 24*a*, *b*, *c*, 1873.

Squalodon catulli Zigno, A. de, Mém. del Istituto Veneto di Sci., Lett. et Arti, Venezia, vol. 20 [extract separately paged, 1–17], pl. —, figs. 1–5, 1876.

Type specimen.—Name proposed for a single serrate cheek tooth which is characterized by striae and by three anterior and two posterior secondary cusps. Type in the "K. K. Hofmineralienkabinet" [=Naturhistorischen Staatsmuseum] at Vienna, Austria.

Type locality.—Not known with certainty for the type specimen was labeled "S. Miniato, Toscana?," Italy. ? Lower Miocene.

Subsequent allocation.—In 1868 Suess[49] described this tooth and considered that it represented an undescribed species. At the time Brandt published his studies on the fossil cetaceans of Europe, squalodonts were very imperfectly known, and it was advisable to place on record every specimen collected. By giving this particular tooth a name, Brandt succeeded in preventing the record of the occurrence of a fossil squalodont in Tuscany from passing into obscurity. The presence of well defined and freely projecting cusps on both anterior and posterior cutting edges places this tooth among the most posterior of the molariform series. A second specimen found near Belluno, Italy, and consisting of a portion of the rostrum with 14 teeth in place was referred to *Squalodon catulli* by De Zigno. This specimen was considered to be very similar if not identical with *Squalodon bariensis* by Dal Piaz.[50] It is not clear why Dal Piaz arrived at this conclusion, unless one is to believe the figures given by De Zigno are inexact. The illustrations accompanying Dal Piaz's article leave much to be desired, and the reproduction of De Zigno's specimen is not nearly as clear as the original plate. A close study of the figures accompanying the accounts of De Zigno, Suess, and Dal Piaz indicate that these two specimens unquestionably belong to the same species. There may be some doubt whether the sixth tooth in the upper jaw has three roots as stated by De Zigno for his figures show only two-rooted molars.[51] The rostral fragment does not possess a complete molar series, and some of the posterior molars may possibly have had three roots. A characteristic feature of the molars of both of these specimens is the peculiar saw-toothed appearance of the anterior cutting edges.

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[49] Suess, E., Jahrb. d. geol. Reichsanstalt, Wien, vol. 18, p. 290, pl. 10, figs. 4a-4c, 1868.

[50] Dal Piaz, G., Palaeontographia Italica, Pisa, vol. 6, p. 310, pl. 28, fig. 1, 1901.

[51] De Zigno, A. de, Mém. del. Istituto Veneto di Sci., Lett. et Arti, Venezia, vol. 20, pl. —, figs. 1–3, 1876.

SQUALODON TIEDEMANI Allen.

Squalodon tiedemani Allen, J. A., Bull. Amer. Mus. Nat. Hist., vol. 2, art. 2, pp. 35–39, pls. 5–6, 1887.

Type specimen.—Consists of the rostral portion of the skull, 50 cm. in length, with 12 teeth in place and 2 vacant alveolae. Type, No. 10445, department of geology, American Museum of Natural History, New York.

Type locality.—Specimen was obtained "in dredging phosphatic material from the Wando River, at Charleston, this material occurring in detached fragments in the mud of the river bottom; it was thus presumably an erratic from the phosphate beds of the neighboring region," South Carolina. ? Edisto marl or Upper Miocene.

Subsequent allocation.—Allen remarks[52] that this rostral fragment indicates a species of much larger size than *Squalodon holmesi*, "and on this account perhaps might be provisionally referred to *Squalodon atlanticus*." The crowns of the premolars of this specimen are imperfectly preserved, and the characters exhibited by the cutting edges of these teeth are thus unknown. Considerable uncertainty exists as to whether or not *Squalodon tiedemani* should be placed nearest the squalodonts or the zeuglodonts. The teeth of this form may suggest relationship with either group, but in the point of size it is much larger than any previously described squalodont. A careful comparison of the types of *Squalodon atlanticus* and *Squalodon tiedemani* has failed to convince the writer that these two cetaceans are closely related to one another.

RHYTISODON TUBERCULATUS Costa.

Rhytisodon tuberculatus Costa, O. G., Atti dell'Accad. Pontaniana, Naples, vol. 7, pt. 1, fasc. 1, pp. 83–84, pl. 6, figs. 16*a*, *b*, 17, 18, 1853 [an earlier reference is quoted, namely, Costa, O. G., Cenni sulle scoperte paleontologiche fatte nel Regno durante l'anno 1851, Naples, pp. 10, 11, 1852].—Capellini, G., Mémorie della Accad. delle Sci. dell'Istituto di Bologna, ser. 3, vol. 9, fasc. 2, pp. 242–243, pl. 2, fig. 4, 1878.

Type specimen.—Original description was based upon one rugose molar tooth, consisting of a nearly perfect crown, but with the base of only one root present, the other having been broken off below the crown. Type, No. 4527, collection of the "Museo geologico della R. Università di Napoli," Italy.

Type locality.—Type tooth came from the "calcare leccese, a mezzo miglio allo incirca dalla Città, verso l'owest, ed alla profondità di palmi 34." Environs of Lecce, Compartment of Apulia, Italy. Langhiano or Lower Miocene.

Subsequent allocation.—It was not until 1864 that Costa[53] understood the true relationships of this tooth and placed it near *Squalodon*.

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[52] Allen, J. A., Bull. Amer. Mus. Nat. Hist., vol. 2, art. 2, pp. 35-39, 1887.

[53] Costa, O. G., Atti dell'Accad. Pontaniana, Naples, vol. 8, Appendice, p. 85, 1864.

SQUALODON TYPICUS, new species.

See *Delphinoides gratelupi* Pedroni.

DIOCHOTICHUS VANBENEDENI (Moreno).

Notocetus Van Benedeni MORENO, F. P., Revista de Museo de La Plata, vol. 3, pp. 397–400, pl. 11, 1892.

Type specimen.—Consists of a skull in a fair state of preservation, mandibles, and a part of the vertebral column. Type in the "Museo de La Plata," Argentine Republic.

Type locality.—Port Madryn on Bahia Nueva, Chubut Territory, Patagonia, latitude 42° 30′ south. Julian beds or Lower Miocene.

Subsequent allocation.—In February, 1894, Ameghino[54] proposed *Diochotichus* as a new generic name for *Notocetus* Moreno because he considered the later name to be preoccupied by *Notiocetus* Ameghino.[55] An additional name, *Argyrodelphis,* was inadvertently proposed for Moreno's specimen by Lydekker.[56]

This form is considered to belong to the family Physeteridae by Winge[57] and to represent the most primitive genus of the Xiphiini. A study of the Pescadores skull, however, convinced True[58] that *Diochotichus* belonged to the family Squalodontidae, or, in other words was a squalodont with simple teeth, having single roots and conical crowns. The posterior teeth are furnished with minute fore-and-aft cusps. It shares the following features with *Squalodon.* The orbital plates of the maxillae are shorter anteriorly than the thicker frontal plates, leaving a considerable portion of the latter exposed in front. The mesorostral channel is open proximally though nearly closed distally by the approximation of the overhanging premaxillae. The zygomatic processes are large, thick, and oblong. The premaxillae are expanded anteriorly and abbreviated posteriorly. A pair of large ophthalmic foramina are also present at the end of the mesethmoid gutter. The presence of these foramina in both *Squalodon* and *Diochotichus* does not necessarily indicate relationship, for they occur also in *Eurhinodelphis.* Furthermore, it differs from *Squalodon* in that the posterior margins of the temporal fossae overhang and project beyond the plane of the condyles.

A somewhat different view of the relationships of *Diochotichus* was advanced by Dal Piaz.[58] This writer proposed a new family, Squalodelphidae, to include the Italian *Squalodelphis* and the Patagonian *Diochotichus.*

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[54] Ameghino, F., Énum. Synopt. Mamm. Foss. Éocén. Patagonie, p. 182, 1894.

[55] Ameghino, F., Revista Argentina Hist. Nat., vol. 1, entr. 3a, p. 167, 1891.

[56] Lydekker, R., Anal. Mus. La Plata, Palaeont. Argentina, vol. 2 for 1893, art. 2, pp. 12–13, April, 1894; Natural Science, vol. 4, No. 24, p. 126, February, 1894.

[57] Winge, H., Smithson. Misc. Coll., Washington, D. C., vol. 72, No. 8, Publ. 2650, p. 38, 1921 (translation by G. S. Miller, jr.).

[58] True, F. W., Bull. Amer. Mus. Nat. Hist., vol. 28, art. 4, pp. 19–32, pls. 1–5, 1910; Dal Piaz, G., Gli Odontoceti del Miocene Bellunese. Parte Terza. Squalodelphis fabianii. Mem. Ist. geol. R. Univ. di Padova, vol. 5, pp. 1–34, pls. 1–5, 1916.

PHOCOCETUS VASCONUM (Delfortrie).

Zeuglodon vasconum DELFORTRIE, E., Actes de la Societe Linneenne de Bordeaux, ser. 3, vol. 9, pp. 113-117, text figs. A, B, C, D, 1873.

Type specimen.—This supposed zeuglodont was described from a single imperfect molar tooth. The specimen was formerly in the private collection of Dr. E. Delfortrie at Bordeaux, France.

Type locality.—Bone breccia of Saint-Médard-en-Jalle, near Bordeaux, France. This deposit is referred to the Middle Miocene by Tournouer.[59] Upper Oligocene.

Subsequent allocation.—Gervais[60] proposed a new genus, *Phococetus*, for this form. Stromer[61] has suggested that certain peculiarities possessed by this tooth, such as the conformation of the enamel crown and the union of the roots, are quite like those exhibited by molars of *Kekenodon onamata.* The lack of more complete material representing both *Phococetus* and *Kekenodon* hinders detailed comparisons. The marked resemblance, however, between some of the molars of *Dorudon serratus* and the published figures of *Phococetus* and *Kekenodon* is strongly suggestive of a close relationship. At any event Abel[62] is justified in remarking that *Phococetus* is at least an offshoot of zeuglodont stock.

It should be noted that Costa[63] has published a figure of an imperfect tooth obtained in Italy which compares favorably with Delfortrie's specimen.

GRAPHIODON VINEARIUS Leidy.

Graphiodon vinearius LEIDY, J., Proc. Acad. Nat. Sci. Philadelphia [vol. 22], p. 122, 1870; Report U. S. Geol. Surv. Terr., Washington, D. C., vol. 1, p. 337, pl. 22, fig. 7, 1873.

Type specimen.—Original description was based on a single tooth which was thought to bear resemblance to a mosasauroid. Type, No. 875, Division of Vertebrate Palaeontology, United States National Museum.

Type locality.—"Miocene Tertiary deposit of Gay Head, Marthas Vineyard," Massachusetts. Upper Miocene.

Subsequent allocation.—It was, no doubt, in part the supposed resemblance in form of this tooth to those of the mosasauroids that induced Leidy to suggest such a determination. The peculiar shape of the tooth and the unusual type of sculpturing present on the enamel crown are unlike any known fossil or recent cetacean. It differs in like manner from the mosasaurs. As teeth with large gibbous roots are characteristic of certain members of the Physeteridae, this form might perhaps be referred to that family. Cope[64] referred this species to the genus *Squalodon*.

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[59] Tournouer, R., Actes Soc. Linn. de Bordeaux, ser. 3, vol. 9, pp. 119-161, 1873.

[60] Gervais, P., Journal de Zoologie, Paris, vol. 5, No. 1, pp. 64-70, text figs. 2, 1876.

[61] Stromer, E. von, Beiträge zur Paläont. u. Geol. Öster.-Ungarns u. d. Orients, Wien, vol. 15, p. 87,

[62] Abel, O., Denkschr. Kais. Akad. Wiss. math.-naturw. Kl. Wien, vol. 90, p. 209, 1913.

[63] Costa, O. G., Atti dell'Accad. Pontaniana, Napoli, vol. 8, Appendice, pl. 5, fig. 7, 1864; Capellini, G., Mémorie della Accad. delle Sci. dell'Istituto di Bologna, ser. 3, vol. 9, fasc. 2, p. 242, pl. 2, fig. 5, 1878.

SQUALODON ? VOCONTIORUM Delfortrie.

Squalodon vocontiorum DELFORTRIE, E., Actes de la Societe Linneenne de Bordeaux, ser. 3, vol. 9, pp. 257–263, pl. 7, figs. 1–5, 1874.

Type specimen.—Consists of a single well-worn molar tooth. Type was formerly in the private collection of Dr. E. Delfortrie at Bordeaux, France.

Type locality.—Taulignan, Department of Drome, France, "sur un mamelon appelé Serre de Vélan, au pied d'une roche sableuse exploitée dans le pays sous le nom de Safre." Helvetian or Middle Miocene.

Subsequent allocation.—This species was considered to be a synonym of *Squalodon grateloupii* Authors by Deperet.[65] The molar is unlike that of any squalodont hitherto described, so far as known to the writer, and probably represents an unknown toothed whale. The molar crown is low and is not incurved toward apex. The tooth is constricted below the enamel crown. Some of these same features are to be observed in the teeth of *Patriocetus grateloupii*.[66]

PARASQUALODON WILKINSONI (McCoy).

Squalodon wilkinsoni McCOY, F., Geol. Mag., London, vol. 4, No. 34, p. 145, pl. 8, fig. 1, 1867.

Type specimen.—A single striate molar tooth characterized by the imperfect bifurcation of the root; the terminal half of one root is missing, the other is blunt with "incurved end." Type in the National Musuem of Natural History, Geology, and Ethnology, at Melbourne, Australia.

Type locality.—The sandy Miocene Tertiary beds of Castle Cove, Cape Otway, coast of Victoria, Australia. Jan Jukian series or Lower Miocene.

Subsequent allocation.—A new genus, *Parasqualodon*, was proposed for this species by Hall.[67] This writer also referred additional teeth found subsequently at Waurn Ponds, Table Cape, and Spring Creek, Australia, to this species. Hall remarks that one of the molars belonging to the collection of the geological department of Adelaide University and from Table Cape, bore the manuscript name, *Zeuglodon brevicuspidatus*, of the late Professor Tate.

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[64] Cope, E. D., American Naturalist, vol. 24, p. 615, 1890.

[65] Deperet, C., Archiv. Mus. Nat. Hist., Lyon, vol. 4, p. 278, 1887.

[66] Suess, E., Jahrb. d. K. K. Geol. Reichsanstalt, Wien, vol. 18, pl. 10, figs. 2a–d, 1868; Ehrlich, C., Ueber die nordöstlichen Alpen, Bericht über das Museum Francisco-Carolinum, Linz, vol. 11, p. 13, fig. c, 1850.

[67] Hall, T. S., Proc. Roy. Soc. Victoria, new ser., vol. 23, pt. 2, art. 23, p. 262, 1911; Richards, H. C., Proc. First Pan-Pacific Sci. Conference held under auspices of Pan-Pacific Union, Special Publ. No. 7, pt. 3, p. 749, Bishop Museum, Honolulu, Hawaii, 1922; Chapman, F., Proc. Roy. Soc. Victoria, new ser., vol. 30, pt. 1, p. 41, Melbourne, 1917.

SQUALODON ZITTELI Paquier.

Squalodon zitteli PAQUIER, V., Mém. Soc. Geol. de France, Paris, Paleontologie, vol. 4, Memoire No. 12, pp.15–16, 1894 [based upon *Squalodon bariensis* Zittel, K. von (not Jourdan), Palaeontographica, Stuttgart, vol. 24, pp. 233–248, pl. 35, 1876–77].

Type specimen.—Consists of an incomplete skull and the anterior portions of the two lower jaws. The rostrum is in an excellent state of preservation with three incisors, one canine, five premolars, and three molars in place on the left side. Four additional molars were present originally as is attested by the alveolae, some of which still contain fragments of the roots.

Both lower jaws are represented by the entire symphysial region and considerably more than the anterior half of either jaw. The left mandible possesses three incisors, one canine, four premolars, four molars, and the anterior root of the fifth. The symphysial region represents more than one-third the total length of either lower jaw. The basioccipital, exoccipitals, squamosals, jugals, and a considerable portion of both postorbital processes of the frontals are missing. The bones forming the vertex and the superior wall of the cranium are sufficiently well preserved to indicate their relations to one another. The type is in the "Palaeontologische Sammlung" at Munich, Germany.

Type locality.—In the neighborhood of the village of Bleichenbach upon the Rott River, 2 kilometers from Birnbach, lower Bavaria, Germany. The specimen was obtained during the excavation of a high sand hill, and was found about 12 feet below the surface. Middle Miocene.

GENERAL DISCUSSION.

The squalodonts according to our present knowledge scarcely attained a length of 20 feet. This, however, is only an estimate based upon isolated vertebrae as very little is known concerning the skeletons of the several forms previously described.

It is premature in the light of available data to consider the validity of the various genera into which the squalodonts have been divided by previous writers; this task will await the acquisition of more complete material. Cetologists are, however, quite aware that the genus *Squalodon* is made up of forms differing greatly in appearance, and that it is much in need of revision.

The following key is based essentially upon data obtained from a careful perusal of descriptions and an extensive comparison of the figures of various authors. Necessarily the possibility for error is considerable, because in fossil cetaceans genera and species have been founded upon totally different parts of the skeleton, which do not permit comparison with one another. This renders it difficult to decide how many of the described forms really represent valid or distinct species. In the case of the shark-toothed cetaceans of squalodonts, 20 supposed new species were based either upon isolated teeth or small fragments of bone with two or three teeth in situ. Many of the others are known only from portions of skulls, and no complete skeleton has thus far been described. It is only by careful deduction that it has been possible for the writer to incorporate many of the species in the key. It will be necessary to observe care in accepting the relationships indicated in the key since the relegation of certain species as allies to others is largely arbitrary and based upon the opinion of the writer. No apology, however, is offered for tabulating the included data as such scattered descriptions retard progess in paleontology as in other sciences more than any errors that may occur in the present key.

The writer realizes that the teeth of cetaceans are not especially adapted for the formulation of a key but the lack of detailed data concerning the skulls and skeletons of most of the described forms prevents one from utilizing such features.

KEY TO THE SHARK-TOOTHED CETACEANS, EXCLUSIVE OF THE ZEUGLODONTIDAE.

MICROZEUGLODONTIDAE.

A^1. Molars small; antero-posterior diameter of crown more than 10 mm. and less than 16 mm.

  B^1. Anterior and posterior cutting edges of molariform teeth with accessary cusps or tubercles; the serrations are as fully developed on the anterior as on the posterior cutting edge. Enamel of crowns of molars lightly sculptured or ornamented with striae.

    b^1. Three accessory cusps present on posterior cutting edge of posterior lower molars. Cheek teeth, apparently, considerably increased above the typical number 44; ten, and possibly more, of those in each maxilla are serrate, and two-rooted (Italy) .... *Neosqualodon assenzae.*
Neosqualodon gastaldii.

    b^2. Four to five accessory cusps present on posterior cutting edges of posterior lower molars (Caucasus) .... *Microzeuglodon caucasicum.*

SQUALODONTIDAE.

Brain case telescoped. Molars with anterior or posterior cutting edges serrated by accessory cusps or tubercles. Crowns of molars ornamented with rugose enamel.

  B^2. Anterior cutting edges of molars and premolars without accessory cusps (so far as known).

    b^1. Enamel of crowns of molars ornamented with longitudinal striae, very coarse around base and finer toward apex. Crowns of premolars compressed (Germany) .... *Microcetus ambiguus.*[68]

A^2. Molars of medium size; antero-posterior diameter of crowns more than 16 mm. and less than 30 mm.

  B^1. Crowns of premolars ornamented with rugose enamel and provided with sawlike cutting surfaces[69] on at least one edge (so far as known).

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[68] *Microcetus,* new genus for *Phoca ambigua* Meyer, 1840. The molars of *Microcetus* are quite unlike those of the other forms grouped under the Microzeuglodontidae. Perhaps they should be allocated with the Squalodontidae.

[69] The sawlike cutting surface referred to in this key should not be confused with the presence of accessory cusps. In the absence of accessory cusps, or when but one or two are present, the anterior and posterior edges of the cheek teeth of many of the squalodonts are transformed into carinae which are notched or toothed. An excellent illustration of this feature will be found on the plate accompanying De Zigno's article in the Memoires del Istituto Veneto di Sci., Lett. ed Arti, Venezia, vol. 20 for 1876. The teeth of this particular specimen, apparently, have this feature very strongly developed.

C^1. Molars (so far as known) with two roots.

D^1. Accessory cusps present on both anterior and posterior cutting surfaces of some of the molars.

E^1. Crowns of premolars not strongly compressed and provided with one crenulate cutting edge (so far as known).

e^1. Molars constricted below enamel crown.

f^1. Roots of molars united at base by a thin isthmus. Posterior cutting edge of at least one molar with five to six accessory cusps (Australia).
Metasqualodon harwoodi.

e^2. Molars not constricted below enamel crown.

f^1. Roots of molars divergent basally, not united by a thin isthmus. Posterior cutting edges of molars with four accessory cusps.

g^1. Accessory cusps on cutting edges of molars distinct, and projecting freely (Australia)........................*Squalodon serratus.*

g^2. Accessory cusps on cutting edges of molars more closely approximating each other. Three or more of the molars in the mandible serrated by accessory cusps on both anterior and posterior cutting edges. Roots of molars short, converging distally and but slightly longer than height of crown (Malta).
Squalodon melitensis.

f^2. Roots of molars united by a thin isthmus for a considerable portion of their length and never widely separated; tips recurved. Roots of molariform teeth nearly twice the height of crown. Premolar with crenulate cutting edge. Enamel surface of molar crown ornamented with coarse anastomosing striae (Australia).
Parasqualodon wilkinsoni.

I. LONG-BEAKED GROUP.

Frontals in contact posteriorly with supraoccipital. Parietals excluded from vertex of skull.

E^2. Crowns of premolars strongly compressed, incurved, and provided with sawlike cutting surfaces on both edges. Enamel surface of molar crown ornamented with striae.

Rostrum elongated, equaling nearly twice the length of that portion of the skull posterior to maxillary notches. External nasal openings situated far posteriorly. Brain case telescoped. No intertemporal constriction. Supraorbital process of frontal expanded laterally, constricted proximally. Frontals in contact posteriorly with supraoccipital, and receive the ascending processes of premaxillae in paired grooves along the internal margins of maxillae. Nasals abbreviated, apparently synostosing with the frontals in old adults. Mesorostral channel open. Mesethmoid fills large frontal fontanelle; forms the thick partition separating the nasal passages externally; provides support for the abbreviated nasals; and is pierced by a second pair of passages, the foramina for the nasal or ophthalmic branches of the trigeminal nerve. Cheek teeth increased above the typical number 44; variable 58 to 60. Molars not exceeding seven and premolars five in either jaw.
SQUALODON

F^1. Both edges of some of the molars provided with sawlike cutting surfaces in addition to the accessory cusps.

f^1. At least five of the molars in each upper jaw with anterior and posterior cutting edges serrated by well-defined accessory cusps. Roots of molars connected near the base by a short thin isthmus.

g^1. Premolars slightly compressed; crowns recurved, the enamel ornamented with longitudinal striae.

Dental formula: $i.\frac{3\text{-}3}{(?\,3\text{-}3)};\ c.\frac{1\text{-}1}{1\text{-}1};\ pm.\frac{5\text{-}5}{4\text{-}4};\ m.\frac{7\text{-}7}{6\text{-}6}.$

Width of rostrum at narrowest point, 50 mm.; width of rostrum at base, 134 mm. Orbital apophysis of the supraorbital process of frontal pointed anteriorly. Mesorostral channel open. Mesethmoid forms a thick partition separating nasal passages superiorly, sheathes the dorsal and lateral faces of the presphenoid in the narial region, fills in the large frontal fontanelle and thus contributes to the formation of a pair of foramina which lead from the cranial cavity to the mesorostral channel, provides support for the vertex of the skull, and underlies the abbreviated nasals. Ascending processes of premaxillae extending posteriad to nasals. Supraoccipital wide, equaling nearly one-half of greatest width of skull across squamosals. Vomer appears in roof of palate as splintlike bone inserted between horizontal plates of the maxillae. Coronoid portion of mandible curved inward and distal portion outward; in consequence the alveolae shift with the postero-anterior curvature of the ramus from a horizontal to a lateral position. Width of tooth bearing portion of the ramus, 19.5 mm. to 27 mm. Symphysis extends backward to second molar and approximates the upper margin of the ramus anterior to alveolae for the last premolar. Ulna possesses a well-developed olecranon process (Maryland)....... *Squalodon calvertensis*, new species.

f^2. About one-half of the true molars in each upper jaw with anterior and posterior cutting edges serrated by well-defined accessory cusps.

g^1. Accessory cusps on the cutting edges of molars closely approximating each other; the four posterior molars unknown. Premolars slightly compressed; crowns lightly fluted.

Dental formula: $i.\frac{3\text{-}3}{3\text{-}3};\ c.\frac{1\text{-}1}{1\text{-}1};\ pm.\frac{5\text{-}5}{4\text{-}4};\ m.\frac{7\text{-}7}{?\text{-}5+}.$

Length of rostrum in advance of maxillary notch more than twice length of cranium posterior to notch. Width of rostrum at anterior extremities of maxillae, 40 mm.; width of rostrum at base about 115 mm. Orbital apophysis of the supraorbital process of frontal truncated anteriorly (rather squarely). Mesorostral channel open. Nasals rudimentary. Frontals forming a relatively broad strip across the vertex and not conspicuously overlapped by the ascending processes of the maxillae. Ascending processes of premaxillae extending posteriad to external narial openings, the distance approximately equivalent to anterior breadth of exposed surface of frontals on vertex (Bavaria)............ *Squalodon zitteli*.

g^2. Accessory cusps on the cutting edges of molars projecting freely; well-defined cusps present on both anterior and posterior edges of the posterior molars. Enamel surface of molar crown roughly sculptured or ornamented with coarse striae (New Jersey). *Squalodon atlanticus*.

F^2. Both edges of some of the molars not provided with sawlike cutting surfaces in addition to accessory cusps.

f^1. At least five of the molars in each upper jaw with anterior and posterior cutting edges serrated by well-defined accessory cusps. Molar crown high, ornamented with coarse striae (France).

Squalodon typicus, new species [=*Squalodon grateloupii* Authors].

f^2. Less than five of the molars in each upper jaw serrated by well-defined accessory cusps on both cutting edges. Roots of some of the molars long, and in some instances there is an indication of a thin isthmus which is, however, short.

g^1. Molar crown high, slightly incurved toward apex. Molars not constricted below enamel crown. Enamel surface of premolars ridged or fluted.

h^1. Accessory cusps present on both cutting edges of posterior molars, though not prominent. Premolars with elongate conic crowns, slightly compressed, forming an obtuse angle with root; enamel surface of crown fluted. Roots of some of the premolars united by a thin isthmus for a considerable portion of their length. Roots of incisors lodged entirely in the premaxillaries; roots of canines lodged in maxillae

Dental formula: $i.\frac{3-3}{3-3};\ c.\frac{1-1}{1-1};\ pm.\frac{4-4}{4-4};\ m.\frac{7-7}{6-6}$

i^1. Width of rostrum at base, 140–144 mm.; width of rostrum at anterior extremities of maxillae, 60 mm. Length of rostrum in advance of maxillary notch slightly less than twice length of cranium posterior to notch. Orbital apophysis of supraorbital process of frontal rounded. Frontals forming a narrow band across the vertex of skull, conspicuously overlapped by ascending processes of maxillae. Mesorostral channel open. Nasals rudimentary. Ascending processes of premaxillae extending slightly posteriad to external narial openings, the distance equivalent to less than anterior breadth of exposed surface of frontals on vertex. Supraoccipital wide, somewhat more than one-half greatest width of skull across squamosals, and forming a shallow "W" shaped outline superiorly (France).

Squalodon bariensis bariensis.

(Italy) *Squalodon bariensis bellunensis.*

i^2. Rostrum relatively wider at base. Frontals forming a wider band across the vertex of the skull. Supraoccipital apparently wider, rounded superiorly and not forming a "W" shaped outline (Italy)..... *Squalodon bariensis latirostris.*

D^2. No accessory cusps on anterior cutting edges of molars (so far as known).

d^1. Molars not provided with sawlike cutting surfaces on either cutting edge.

e^1. Roots of molars divergent at base, not united by a thin isthmus.

f^1. Anterior and posterior cutting edges of premolars distinctly sawlike. Incisors ornamented with coarse longitudinal striae or fluted. Roots of molars long, curving posteriorly and approximately equally distant from each other throughout their length; the roots are longer than maximum breadth of crown and the posterior roots of some of the molars equal more than twice the height of crown. Accessory cusps on posterior cutting edges of molars well developed.

Dental formula: $i.\frac{3-3}{3-3};\ c.\frac{1-1}{1-1};\ pm.\frac{5-5}{4-4};\ m.\frac{7-7}{?-6+}$ (Belgium).

Squalodon antverpiensis.

e^2. Roots of molars united by a thin isthmus for a portion of their length.

f^1. Roots of molars not strongly bifurcated; crowns high. Three to four accessory cusps on posterior cutting edge of molars (Germany). *Pachyodon mirabilis.*

d^2. Molars provided with sawlike cutting surfaces on at least one edge.

e^1. Roots of molars divergent but connected at base by a short thin isthmus.[70] Enamel crowns of molars ornamented with coarse longitudinal striae. Anterior and posterior cutting edges of premolars indistinctly sawlike. Crowns of premolars slightly compressed and incurved; striae coarse at base and disappearing toward apex of crown. Incisors with very long, narrow, and fluted crowns. Nasal passages situated in advance of nasals, but their posterior margins lie in same plane as anterior margins of nasals. Ascending processes of the premaxillae extending as far as but hardly beyond posterior margins of nasals. Nasals reduced in size. Frontals forming a narrow strip across vertex of skull. Width of supraoccipital superiorly less than one-half greatest width of skull across squamosals. Decending free plates of basioccipital greatly reduced in extent. Vomer overlaps the basisphenoid and apparently extends backward to the basioccipital (Germany)................ *Arionius servatus.*
Squalodon meyeri.
Squalodon molassicus.

e^2. Roots of molars divergent basally, and not united by a thin isthmus. Enamel of crown strongly rugose, characterized by anastomosing striae. Anterior edge of molar possesses a sawlike cutting surface on basal half of crown. Posterior cutting edge of molar tooth with three well-defined accessory cusps (Italy)..*Rhytisodon tuberculatus.*

C^2. Molars (one or two) with three roots.

c^1. Anterior edges of premolars and some of the molars characterized by sawlike cutting surfaces.

d^1. Accessory cusps on posterior cutting edges of molars steplike; one of the three roots of at least one posterior molar recurved posteriorly to, or beyond tip of the middle root (Italy).... *Trirhizodon catulli* (Molin).
(France) *Trirhizodon gervaisii.*

d^2. Accessory cusps on posterior edges of molars well defined and freely projecting; the first four molariform teeth lack well-defined accessory cusps on anterior edge; roots long, united by a thin isthmus for a short portion of their length (Italy) [Tuscany]... *Trirhizodon suessii.*
(Italy) [Venetia] *Trirhizodon catulli* (Zigno.)

II. SHORT-BEAKED GROUP.

Frontals separated from the supraoccipital on the vertex of the skull by the parietals.[71]

B^2. Crowns of premolars not provided with sawlike cutting surfaces.

C^1. Molars not constricted below enamel crown. Anterior and posterior cutting edges of molars serrated by accessory cusps. Molariform teeth have crowns ornamented with coarse striae. Anterior teeth are single rooted, with coarse striae. Parietals separate the frontals from the supraoccipital by a narrow interval on the vertex of the skull. Skull with reduced intertemporal constriction.

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[70] Probst, J., Jahreshefte d. Vereins f. vaterl. Naturkunde in Württ., pl. 1, 1885.

[71] Abel, O., Sitzungsber. math.-naturw. Kl. Kais. Akad. der Wissenschaften Wien, vol. 121, pt. 1, text fig., p. 61, and pl. 1, 1912.

c^1. Molars united throughout their length by a thin isthmus, and two rooted. Five to six pairs of two-rooted mandibular teeth. Rostrum broad at base and very short. External nasal openings situated posterior to the maxillary notches. Maxillary notches narrow in consequence of the conspicuous antero-external projection of the maxillae as in physeterine whales. Nasals triangular in shape and partially roof over nasal apertures. Mesethmoid forms the thick partition separating the nasal passages externally, provides support for the abbreviated nasals, and sheathes dorsal and lateral faces of the presphenoid which in turn forms the plug across proximal end of mesorostral channel. Mesorostral channel open. Supraorbital process of frontal broad, expanded laterally. Supraoccipital narrow, equaling about one-half of greatest width of skull across the squamosals, emarginate superiorly. Parietals forming a narrow strip across the vertex. Premaxillaries bounding the nasals laterally, but not extending posteriad to them, and overlapping frontals on vertex to a slight extent. Zygomatic portion of squamosals bluntly truncated anteriorly. Maxillaries extending posteriad beyond tips of premaxillaries and in contact with parietals on vertex. Mandibular symphysis shorter than in *Squalodon*. Mandible short and laterally curved. Atlas is long anteroposteriorly with two superimposed transverse processes on either side, and possesses a stout median postero-inferior process for odontoid (Patagonia)........................*Prosqualodon australis*

C^2. Molars constricted below enamel crown. Anterior and posterior cutting edges serrated by accessory cusps. Parietals separate the frontals from the supraoccipital by a wide interval on vertex of skull.

PATRIOCETIDAE.

Skull with reduced or no intertemporal constriction.

D^1. Crowns of molars low; cusps on posterior edges large, with bluntly rounded apices. Roots of molars not united by a thin isthmus, widely divergent basally. Crowns of incisors compressed and curved inward, their anterior and posterior cutting edges sharp. Enamel surface of molar crown ornamented with coarse striae.

d^1. Maxillae narrowly overlapping frontals mesally with splintlike ascending processes, and not extending posteriad to anterior margins of temporal fossae. Rostrum broad at base, and relatively short. Maxillary notches wanting. External nasal openings situated more anteriorly than in *Squalodon*. Supraorbital processes of frontal broad, expanded laterally. Premaxillaries bounding nasals laterally, overriding frontals mesally, and extending posteriad as far as anterior margins of parietals on vertex. Parietals forming a broad strip across the vertex. Supraoccipital narrow, equaling less than one-half greatest width of skull across squamosals, truncate superiorly. Zygomatic portion of squamosal tapering anteriorly. Mesorostral channel wide open. Occipital condyles large, their posterior margins produced beyond overhanging edges of temporal fossae (Austria)..*Patriocetus grateloupii.*
Patriocetus denggi.

AGOROPHIIDAE.

Skull with a distinct intertemporal constriction.

D^2. Crowns of molars high, triangular in outline; cusps on cutting edges small. Roots of molars united by a thin isthmus. Enamel surface of molar crown lightly sculptured.

d^1. Maxillae broadly overlapping frontals and not extending posteriad to anterior margins of temporal fossae. Rostrum broad at base, short and stout. Maxillary notches reduced in extent. External nasal openings situated more anteriorly than in *Squalodon*. Supraorbital process of frontal broad, expanded laterally, its anterior margin rounded and its posterior produced backward as the tapering postorbital process. Premaxillaries bounding nasals laterally, overriding frontals mesally, but terminating in advance of anterior margins of parietals. Parietals form the intertemporal region of the skull. Supraoccipital subtriangular in outline, equaling at base more than one-half greatest width of skull across squamosals. Mesorostral channel open. Occipital condyles large, their articular faces and necks produced beyond posterior margins of temporal fossae (South Carolina)......*Agorophius pygmaeus*

DESCRIPTION OF A NEW SPECIES OF SQUALODON FROM THE CALVERT CLIFFS, MARYLAND.

SQUALODON CALVERTENSIS, new species.

Type.—No. 10484, Division of Vertebrate Paleontology, United States National Museum. This specimen consists of a nearly complete skull, including the greater portion of the rostrum; the palatal region is imperfect, and the jugals are missing. One periotic is preserved. Four molars, three premolars, and four incisorlike teeth were found associated with the skull. A mandible, two dorsals, and three lumbar vertebrae, six isolated epiphyses of vertebrae, ten ribs and one ulna also belong to this specimen.

Type locality.—The occurrence is as follows: Near latitude 38° 40′ and longitude 76° 32′ on the western shore of Chesapeake Bay, about 2 miles south of Chesapeake Beach, Calvert County, Maryland. Shown on Patuxent Quadrangle or Patuxent Folio No. 152, United States Geological Survey.

Horizon.—The specimen was discovered and excavated by Norman H. Boss on July 8, 1921. It was dug from the cliffs 5 feet above the beach. The oyster shell stratum is not visible at this point and is probably well under the beach level. The specimen apparently was dug from Shattuck's zone 6 of the Calvert Miocene formation of Maryland.

SKULL.

Dorsal view.—The most obvious peculiarity of this skull (pl. 1) is the apparent expansion of the rostrum at the tip. Some doubt may exist whether this modification was a natural one or whether it was the result of pressure exerted by the overlying strata. The separation of the premaxillae may have occurred during the process of weathering subsequent to the animal's death and before it was covered by the sediments which insured its future preservation. The imperfect state of preservation of certain exposed parts of the skull lends some support to the latter view. Otherwise, the long-tapering rostrum presents essentially the same features as other previously described long-beaked squalodonts. It comprises more than two-thirds of the total length of the skull and was originally still longer. The narrowest portion is slightly in advance of the middle. The mesorostral gutter was open the full length of the rostrum, though the premaxillae approximate each other so closely at a point anterior to the middle that it may have been nearly closed at this point. Distally, this gutter is formed entirely by the premaxillae, which meet mesally and ventrally in a linear suture in front of the alveolae or the first molars; proximally, the vomer and the premaxillae contribute to its formation. The dorsal margins of the mesorostral gutter are formed by the overhanging edges of the premaxillae.

In the squalodonts, in consequence of the prolongation of the snout into a beak, the vomer acquires a considerable length and is so placed as to afford support for the premaxillae as well as the maxillae, and on the base of the skull extends backward as far as the basisphenoid. The vomer disappears in the floor of the mesorostral gutter slightly in advance of the narrowest portion of the rostrum or above the alveolae for the second molars. It increases in width posteriorly, and in the region just anterior to the alveolae for the fifth molars takes part in the formation of the lateral walls. On either side it is in contact with the adjoining premaxilla, the surfaces being smoothly mortised into one another. This contact between the vomer and the premaxilla has its posterior limit at the anterior margin of the presphenoid.

The premaxillae are bowed, and approximate each other closest, as remarked above, at a point anterior to the middle of the rostrum. Just anterior to the premaxillary foramina the premaxillae commence to expand horizontally, and rapidly increase in width to a point 20 mm. in advance of the mesethmoid. From this point posteriorly, they diminish in width, the internal margins being deflected ventrally as they approach the external nasal passages. Posterior to the anterior margins of the nasals they send back splintlike ascending processes, which are lodged in deep paired grooves in the frontals on either side of the internal margins of the maxillae.

The mesethmoid does not rise to the level of the premaxillae. It forms a thick partition separating the nasal passages superiorly, fills in the frontal fontanelle, provides support for the vertex of the skull, and underlies the nasals. Ventrally, the mesethmoid sheaths or forms a thin veneer of bone around the dorsal and lateral faces of the presphenoid, thus lining the internal walls of the nasal passages superiorly. The pterygoids, apparently, send thin laminae of bone dorsally to sheath the external walls of these passages. The presence of a second pair of passages which open at the posterior end of the mesethmoid gutter and lead into the brain case is a matter of unusual interest. These formina owe their distinctness to that portion of the mesethmoid which incompletely fills in the large frontal fontanelle and supports the nasals, leaving a small pair of passages on either side. They are here interpreted as transmitting the nasal branches of the ophthalmic (V) nerve.

The dorsal surface of the skull is constituted largely by the maxillae and the premaxillae, and to a less extent by the frontals. The maxillae make up the greater part of the dorsal surface. They expand suddenly just posterior to the maxillary notches, forming what may be called the frontal plates. These partially roof over the temporal fossae. Each maxilla terminates slightly in advance of the supraoccipital posteriorly. The internal margin of the maxilla is in contact with the premaxilla for practically the entire length. The surface of the maxilla is slightly depressed opposite the nasals, but plane elsewhere. The free or external margin is thinner than the internal. The orbital plate of the maxilla does not completely cover the thick apophysis of the supraorbital process of the frontal but leaves a considerable portion of the latter exposed in front and at the side. The broad base of the rostrum is formed largely by the lateral expansion of the maxillae.

The cranial region of the skull is quadrilateral in outline. As remarked above, the frontal plates of the maxillae constitute the greater part of the dorsal surface, the lateral extensions of the frontals being concealed for the most part by these bones. The nasal bones do not overhang the nasal openings and are considerably shortened. Posteriorly, they are suturally united with the frontals. The nasals present a quadrangular outline, truncated anteriorly, and emarginate posteriorly.

The rostral or anterior wall of the brain cavity is composed largely of a vertical sheet of bone formed by the paired frontals. Between these is a large frontal fontanelle which as it closes is filled in by the mesethmoid. Support to this view is lent by the figures of *Squalodon zitelli.*[72] The fontanelle is still open in Zittel's specimen. The element labeled *pa.* [= parietal] in his figure is really the supraoccipital. The Maryland squalodont and Zittel's specimen admirably supplement each other and there is little chance for error in defining the relations of the various bones. Each frontal sends back a thin isthmus which unite by suture along the median line and form the vertex of the skull. Posteriorly, they are in contact with the supraoccipital and anteriorly are synostosed with the nasals. Laterally and at a lower level than the vertex the frontals widen out, support the maxillae, and give rise anteriorly to the supraorbital processes. The apophyses of the supraorbital processes are rather pointed, the internal margin sloping obliquely toward the cranium, the external more rounded and less declivent.

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[72] Zittel, K. von, Palaeontographica, Stuttgart, vol. 24, pl. 35, figs. 1 and 3, 1876-77.

The maxillary notch formed by the angle between the apophysis or preorbital portion of the supraorbital process of the frontal and the adjoining portion of the maxilla is deep and acute. The maxillary foramina are situated 30 mm. in advance of the maxillary notches.

Posterior view.—As seen from the occipital view (pl. 4) the supraoccipital takes the form of a wedge-shaped bone, wider above than below. The conspicuous development of the lambdoidal crest is the characteristic feature of the back of the skull. Superiorly, the crest is formed by the margin of the supraoccipital which abuts against the frontals. On the inner sides of the temporal fossae the crest curves ventrally and laterally, following the contour of the posterior margins of the fossae.

The exoccipitals are rather large, coalesced with the supraoccipital above and projecting outward and backward like wings of the former. The external margins are rounded. Laterally and anteriorly they are in contact with the squamosals, while below they are fused internally with the basioccipital. The sharp-edged lambdoidal crest overhangs the exoccipitals on either side.

The opening for the foramen magnum was originally circular. The occipital condyles are semielliptical in outline with their long axes directed dorso-ventrally. They are strongly convex from side to side. The internal margins are concave and sharply defined, converging inferiorly. The external margins of the condyles are not set off from the exoccipitals by shallow concavities, but gradually merge into the exoccipitals. Ventral to the condyles and internal to the exoccipitals are the descending free plates of the basioccipital. Ventral to the temporal fossae and external to the exoccipitals are the large squamosals and their zygomatic processes.

Lateral view.—The lateral aspect (pl. 3) of the rostrum is formed almost entirely by the maxilla, though the tip was presumably made up by the premaxillae alone. The thickness of the broken anterior edge of the maxilla indicates that it extended some distance farther forward, how far, can only be surmised by comparison with other described forms. This view best illustrates the upturning of the anterior half of the rostrum which imparts a peculiar bowed appearance to the superior outline of the skull.

The skull as a whole is rather slender, and the height at the vertex is proportionately low in comparison with that of the base of the rostrum. A large alveolar gutter, with the septa between the alveolae formed of porous bone, terminates 62 mm. in advance of the maxillary notch. The supraorbital process of the frontal is concave above and below. The preorbital process or apophysis is rounded; the postorbital process is abruptly truncated and sharp edged.

The zygomatic process of the squamosal is slender, curved, and tapering anteriorly. The postglenoid process is thin, directed more downward than backward. The temporal fossa is quite large, with the superior margin formed by the frontal and the overlying maxilla. In either temporal fossa the parietal is suturally united inferiorly with the squamosal, anteriorly with the frontal, and superiorly is synostosed to the thick lateral margins of the supraoccipital, forming an apparently continuous surface. The parietals are thus excluded from the dorsal surface and from the vertex of the skull.

A close examination of the surface of the cranium in the left temporal fossa shows a fissure in front of the squamosal and at its anteriormost point of contact with the parietal. This fissure is partially filled in by a triangular wedgelike bone which is interpreted to represent the ala temporalis or alisphenoid. The position of this bone and its relations to the surrounding elements correspond in all essential details with the same element in the skull of a foetal *Balaenoptera* in the United States National Museum. Unfortunately, the cranium on the right side is so badly broken in the region of the temporal fossa that no additional information can be obtained from that side of the skull regarding the relations of the alisphenoid to the other bones. In front of the parietal and above the aforementioned fissure, the frontal takes part in the formation of the lateral wall of the cranium.

Viewed from the side the condyles project beyond the plane of the exoccipitals. The skull has not been restored in the palatal region. The palatines and pterygoids, if present, would impart a slightly different appearance to this part of the skull.

Ventral view.—The basioccipital is a relatively narrow bone with ventral surface concave from side to side, and terminated posteriorly by the paired condyles. Anteriorly, it is synostosed with the basisphenoid. The sides of the basioccipital are prolonged downward into free plates, which are characterized by convex swellings on internal and external sides. In this feature this skull (pl. 2) differs from the type of *Squalodon bariensis*.[73] In the latter, the descending plates are reduced in extent and are much longer anteriorly than posteriorly. These plates in *Squalodon bariensis* also join the pterygoids in front, which are hollowed out inferiorly to form the palatine vacuities. A close examination of the skull of the squalodont from Maryland reveals features which might suggest a different type of architecture in the palatine region. Since the palatines and the pterygoids are completely missing from this specimen there is no opportunity for further comparisons.

The descending plates of the basioccipital serve as the internal walls for the scaphoid fossa, the anterior and outer boundaries of which are furnished by the descending lateral wings of the basisphenoid, and the squamosal. A large and well-marked groove which originates within the cranial cavity follows down the external face of the descending plate of the basioccipital along its line of union with the exoccipital. This is interpreted to be the posterior lacerated foramen. Condylar foramina are present on either side of the basioccipital.

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[73] Lortet, L., Archiv. Mus. d'Hist. Nat. de Lyon, vol. 4, pl. 25*bis*, 1887.

The basisphenoid is flat in comparison to the basioccipital and the anterior margin was concealed to some extent by the vomer and the vaginal plates of the internal pterygoids. If the sutures have been correctly ascertained the basisphenoid does not enter into the formation of the lateral descending plates of the basioccipital except at the base and then only in front of the line of contact between these two elements.

The presphenoid is permanently separated from the basisphenoid by an open transverse suture, apparently paralleling in this respect *Squalodon zitteli.*[74] This region in the skull of *Squalodon bariensis* is concealed by the vomer and the adjoining vaginal processes of the internal pterygoids. The posterior end of the vomer as preserved in the Maryland squalodont commences 112 mm. in advance of the foramen magnum. As remarked above, the imperfect state of preservation of this portion of the skull prevents accurate description. However, the free ends of the palatine plates of the maxillae show that the palatines were suturally united to the former, and that they did not extend as far forward as the maxillary notches. On the other hand Lortet's figure of *Squalodon bariensis* suggests that the palatines may have terminated in front of the maxillary notches.

The vomer first makes its appearance on the ventral surface of the skull as a splintlike bone inserted between the palatine plates of the maxillae, commencing near the alveolae for the second molars and disappearing on a line with the seventh as in *Squalodon zitteli.* It again makes its appearance posterior to the internal openings of the nasal passages. In order to insure a correct contact between the two major portions of the matrix during the preparation of this specimen it was necessary to fill in this portion of the skull with plaster of Paris, and no attempt was afterwards made to restore these passages to their natural appearance. The vomer is characterized by a well-developed carina, though this, presumably, is merely a posterior continuation of the ascending plates that sheath the internal walls of the nasal passages inferiorly.

The squamosals are produced outward and the zygomatic processes thus formed do not closely approach the posterior part of the supraorbital processes of the frontals as in *Squalodon bariensis*, but are separated by a wide interval. The squamosal is firmly fixed to the side of the skull and internally forms part of the wall for the cranial cavity. The petrous portion of the squamosal fills in most of the tympano-periotic recess and internally is suturally united to a lateral wing of the basisphenoid. The posterior and outer part of the squamosal is produced downward into a thin lamina or postglenoid process. The glenoid surface of the squamosal is rather wide and concave from side to side. Behind the glenoid process is a blunt knoblike tuberosity, between which and the postglenoid process is a broad channel while behind this knob or rather between it and the exoccipital, there is a narrower and deeper groove or suture. The channel on the squamosal posterior to the postglenoid process is the groove for the external auditory meatus, which continues its course upward in a deep depression on the posterior face of the postglenoid process of that bone, and terminating some 70 mm. above the tip of that process.

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[74] Zittel, K. von, Palaeontographica, Stuttgart, vol. 24, pl. 35, fig. 3, 1876–77.

In *Squalodon bariensis* the jugal extends from the maxillary notch to the antero-inferior margin of the zygomatic process of the squamosal. The broken edges and the roughly sculptured surface of the posterior margins of the lachrymals of the Maryland squalodont indicates that the jugal occupied a similar position.

The horizontal ventral plates of the maxillae contribute largely to the formation of the roof for the oral cavity. They are separated from each other for most of their length by the splintlike strip of vomer, and are in contact only posterior to the alveolae for the last molars. Their surfaces are strongly convex posteriorly, and taper rapidly anteriorly. The maxillae are not prolonged over the ventral faces of the supraorbital processes of the frontals. The presence of the lachrymal makes such an extension impossible.

In the zeuglodonts[76] the lachrymal occupies a position at the base of the rostrum and on the external margin of the supraorbital process; it is bounded posteriorly and internally by that process, and anteriorly by the maxilla. A change in the architecture of the skull from the zeuglodont to the squalodont type, particularly in the rostral region, and the resulting constriction of the base of the rostrum and formation of the maxillary notches, would result in the shifting of the lachrymal to a more internal position. If the sutures which bound a small area on the right maxilla are real and not apparent, then the position of the lachrymal in the Maryland squalodont is in accordance with what would be expected in such a modification and its relation to the adjoining bones remains unchanged. Some squalodont skull in a better state of preservation may show that the above interpretation is incorrect, for in the Iniidae the lachrymal is a small wedgelike bone which fills the interval between the posterior margin of the ventral plate of the maxilla and the supraorbital plate of the frontal.

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[76] Andrews, C. W., A descriptive catalogue of the Tertiary vertebrata of the Fayûm, Egypt. London, text fig. 80, p. 244, 1906.

PERIOTIC.

The right periotic (pl. 8, figs. 5–6) of *Squalodon calvertensis* differs considerably from that of *Eurhinodelphis longirostris*[76] and possesses many of the structural peculiarities exhibited by those of *Delphinodon dividum*[77] and *Prosqualodon australis*.[78] The bone may be described as irregularly triangular. The posterior end, or mastoid process of petrosal, is short and stout, while the anterior end of the petrosal resembles a twisted cone. On the ventral face of the anterior process of the petrosal there is a circular depression in which the head of the malleus is lodged. The malleus, presumably, was united with the tympanic and situated anterior to the caudal lip of the bulla. The mastoid process of the petrosal fits loosely into a notch on the squamosal, yet the contact shows that correct relations were maintained with the open channel for the external auditory meatus. The anterior face of this process is hollowed out. The pedicle on the posterior end of the tympanic rests on the flattened and rectangular ventral face of the mastoid process of the petrosal.

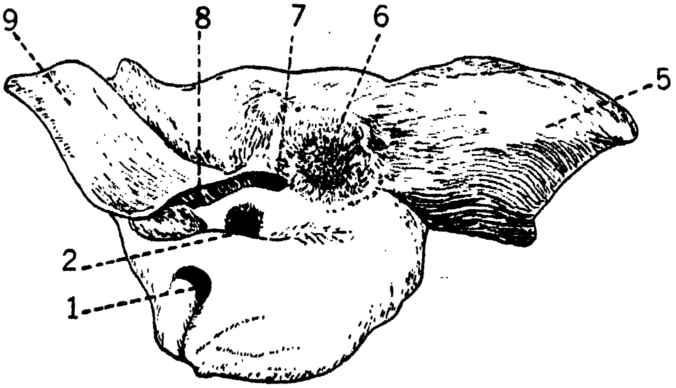

FIG. 1.—DORSAL VIEW OF RIGHT PERIOTIC OF SQUALODON CALVERTENSIS, NEW SPECIES. ×2. NO. 10484, U.S.N.M.; CALVERT CLIFFS, MARYLAND. THE SAME NUMBERS ARE USED IN FIGURES 1 TO 3 FOR THE FOLLOWING PARTS: 1, FENESTRA ROTUNDUM; 2, FENESTRA OVALIS; 3, EXTERNAL APERTURE OF AQUAEDUCTUS COCHLEAE; 4, EXTERNAL APERTURE OF AQUAEDUCTUS VESTIBULI; 5, PROCESSUS ANTERIOR PETROSI; 6, PIT FOR HEAD OF MALLEUS; 7, TYMPANIC APERTURE OF FACIAL CANAL; 8, SEMICLOSED CANAL FOR FACIAL NERVE, WITH GROOVE FOR STAPEDIAL MUSCLE; 9, PROCESSUS POSTERIOR PETROSI (MASTOID PROCESS, IN PART); 10, INTERNAL ACOUSTIC MEATUS; 11, FORAMAN CENTRALE; 12, FORAMEN SINGULARE; 13, INTERNAL OR CEREBRAL APERTURE OF FACIAL CANAL.

A thin ledge is formed by the internal prolongation of the inferior margin of the mastoid process of the petrosal which partially roofs the fallopian or facial canal posteriorly. The tympanic cavity of the internal ear of this squalodont periotic is limited externally by this crest. The deep and narrow groove which forms the facial canal commences on the posterior margin of the periotic and leads to the opening for the fallopian tube. The fenestra ovalis lies below this canal and on the lateral face of the labyrinthic portion of the periotic. The duct passes obliquely upward. The absence of any stapes suggests that it was not firmly fixed as in some of the whalebone whales. Perhaps an annular ligament held the stapes in place since it did not completely fill the fenestra ovalis with its foot plate.

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[76] Abel, O., Mém. Mus. Roy. Hist. Nat. Belgique, Bruxelles, vol. 2, fig. 19, p. 122, 1902.

[77] True, F. W., Journ. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 15, p. 175, pl. 25, figs. 6–11, 1912.

[78] True, F. W., Smithson. Misc. Coll. (Quart. Is.), vol. 52, pt. 4, Publ. 1875, fig. 78, p. 452, 1909.

The inferior half of the central portion of the periotic corresponds to the labyrinthic region. On the posterior end of this structure there is a semicircular opening, the fenestra rotundum. A rounded promontory is formed above this opening by the closure of an open groove, which, at some time during this cetacean's growth, extended across the posterior face of the labyrinthic and opened on the internal face. This groove represents the common opening of the fenestra rotundum and the external aperture of the aquaeductus cochleae. A small canal connecting the fenestra rotundum with the external aperture of the aquaeductus cochleae remains open. The apertures for the facial canal, fenestra ovalis, fenestra rotundum, and the external aperture of the aquaeductus cochleae, as well as the course of the facial canal are practically identical in position with those of *Delphinodon.*

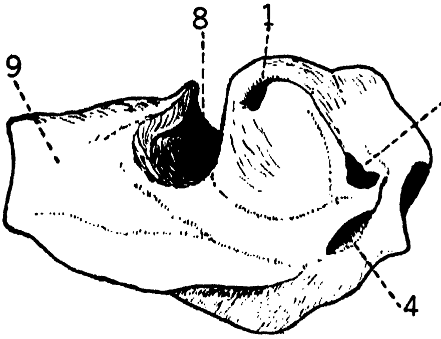

FIG. 2.—POSTERIOR VIEW OF RIGHT PERIOTIC OF SQUALODON CALVERTENSIS, NEW SPECIES. ×2. NO. 10484, U.S.N.M.; CALVERT CLIFFS, MARYLAND.

On the dorsal face and near the posterior margin is a partially closed suture which presumably marks the line of contact between the mastoid and the labyrinthic portions of the periotic.

The most noticeable feature of the internal face is a large elliptical opening, the roof of which defines the limits of the labyrinthic and petrous portions of the periotic. Within this opening a thin bony partition separates the aperture for the facial canal from a deep and more centrally placed fossa. This fossa represents the internal acoustic meatus which receives the acoustic nerve and the internal auditory artery. At the bottom of this fossa is the tractus spiralis foraminosus, but this structure is barely visible. A small foramen is present at the top of the previously discussed bony partition and leads into the vestibular portion of the periotic. This could transmit the vestibular branches of the acoustic nerve and the internal auditory artery. It may, perhaps, represent the foramen singulare which gives passage to the nerves for the ampullae. On the floor of the acoustic meatus is a small foramen which enters the cochlear portion of the periotic. If the homologies are correct this would be the foramen centrale and would afford passage for the cochlear branches of the acoustic nerve. The meatus is approximately 8 mm. deep and 4.5 mm. wide. The passage anterior to the internal acoustic meatus as already stated represents the internal opening of the facial canal or fallopian tube, which appears in the epitympanic recess as described above, and pierces the periotic obliquely.

On the posterior margin of the periotic and superior to the acoustic meatus there is an opening which is interpreted to represent the external aperture for the aquaeductus vestibuli.

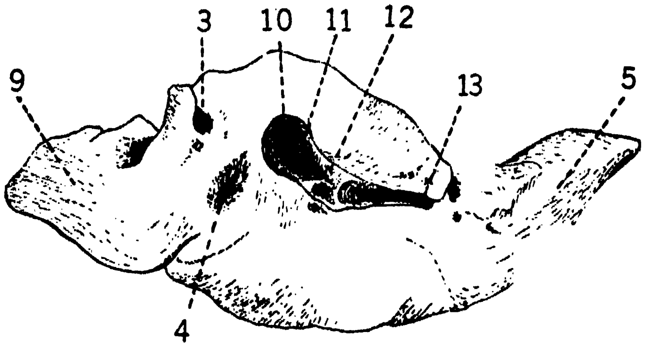

FIG. 3.—INTERNAL VIEW OF RIGHT PERIOTIC OF SQUALODON CALVERTENSIS NEW SPECIES. ×2. NO. 10484, U.S.N.M.; CALVERT CLIFFS, MARYLAND.

The dorsal surface of the anterior process of the petrosal rests against the petrous portion of the squamosal and the anterior margin is in contact with the internal pterygoid process of the alisphenoid. Internally, the anterior process is so intimately fused to the posterior process of the petrosal that they are unrecognizable as separate elements.

MANDIBLE.

The lower jaw is quite large in comparison with the size of the cranium and its general conformation is similar to those of other described squalodonts. Back of the last molar the rather delicate coronoid rises abruptly, and near the same point the inferior margin of the ramus is deflected downward; in consequence the coronoid is quite deep and strongly convex on the external face. Little more can be said concerning this portion of the mandible for the angle and the condyle are both missing. A long symphysis extends back to a point beneath the anterior margin of the alveolus for the second molar. The tooth-bearing portion of the lower jaw is relatively shallow, and consists of a thin shell of bone. Posteriorly the frame diminishes in thickness and in the region anterior to the coronoid, and on the internal face it is no thicker than blotting paper and very fragile. The internal portion of the ramus consists of an expanded papyraceous area opened for the whole length of the mandible by an enormous inferior dental canal. The proximal portion of the mandible is deep and thin, gradually tapering in depth rostrally though increasing in width. The external surface is convex and the internal somewhat flattened. The coronoid portion of the mandible curves inward and the distal portion outward. The alveolae shift with the postero-anterior curvature of the mandible from a horizontal to a lateral position.

In general outline the mandible of this Maryland squalodont recalls *Squalodon zitteli*[79] from the Miocene of Bavaria. The length of the symphysis, the proportions of the ramus, and the large size of the anterior alveolae are features common to both specimens.

TEETH.

More than 50 years ago two fragments of a squalodont skull, obtained from the Calvert formation of Charles County, Maryland, were submitted to Cope by James T. Thomas. Each of these fragments possessed three serrate two-rooted molar teeth. In describing these teeth, Cope[80] compares them with two European species and then concludes they are referable to Leidy's form *Squalodon atlanticus*. The measurements given by Cope and the figures accompanying Leidy's[81] report agree with the size of the alveolae of the skull discussed in the present paper. Certain features pointed out by Cope and Leidy, such as the "more elevate conic apex" of the crown and the "less strongly wrinkled" enamel, suggest a close relationship with the present species. On the whole there is considerable resemblance between Cope's squalodont and *Squalodon calvertensis*, taking into consideration the size and shape of the teeth, the ornamentation of the enamel, and the number of accessory cusps. In addition, these two specimens were obtained from deposits belonging to the Calvert formation.

The squalodont described by Cope and the present specimen are quite different from *Squalodon atlanticus*. The four teeth shown on Leidy's plate represent the third to the sixth molars, inclusive, judging from comparative measurements and size of the accessory cusps. These molars are not represented among the teeth preserved with the skull under discussion. Eleven isolated teeth were found embedded in the matrix surrounding the skull. An examination of the alveolae of the skull and mandible shows that the teeth were implanted obliquely and that the posterior root usually underlies the anterior root of the following tooth.

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[79] Zittel, K. von, Palaeontographica, Stuttgart, vol. 24, pl. 35, figs. 1, 3, 1876-77.

[80] Cope, E. D., Proc. Acad. Nat. Sci. Philadelphia [vol. 19], pp. 132, 153-154, 1867.

[81] Leidy, J., Journ. Acad. Nat. Sci. Philadelphia, ser. 2, vol 7, pl. 30, fig. 18, 1869.

A nearly perfect specimen of the last lower molar on the right side is represented in Figure 1, Plate 7. It conforms to the size and peculiar shape of this alveolus in the mandible, and there seems little or no chance for error in relegating the tooth to this position. Furthermore, it agrees in all essential details of form with similar last molars of previously described squalodonts.[82]

The crown is low and roughly sculptured or covered with longitudinally striate enamel. The main cone or apex of the crown is depressed and bent backward. The anterior cutting edge slopes obliquely backward and is serrated by two low blunt accessory cusps, which incline in the direction of the main cusp, as well as by several small tubercles. On the posterior margin there are two well-defined cusps, one freely projecting and situated near the base of the crown, the other closely appressed to the main cone or apex of the tooth. The roots are short and stout. They are widely separated at the base and diverge rapidly, the anterior root being recurved distally.

The serrulated cutting edges of the second left upper molar (pl. 7, fig. 2) conform to the type of tooth which would be needed to supplement the series shown by Leidy's figure. The enamel surface is ornamented by a rugose network of striations which tend to assume a longitudinal arrangement on the apical portion of the crown. These striae are coarse toward the base and become finer toward the summit. The two accessory cusps on the anterior edge of the crown are restricted to the basal portion; they are low steplike and incline in the direction of the main cone. The three cusps on the posterior edge project freely and are provided with sharp edges. They are nearly equal in size. The apical half of the crown is not serrated by additional cusps, but the anterior and posterior margins exhibit indistinct sawlike cutting surfaces. The posterior root is longer and stouter than the anterior. The roots are connected by a short thin isthmus at the base and do not diverge to any marked extent distally. Cope remarks that the roots of the molars of his squalodont were connected by a thin lamina at the base. *Squalodon atlanticus* lacks this modification.

An incomplete second upper molar (pl. 7, fig. 4) from the opposite side of the skull exhibits no additional features. The anterior half of the crown is broken off.

The allocation of some of the following teeth must be regarded as more or less provisional, for all the alveolae can not be opened sufficiently to insert the roots of the teeth for their full length. Certain of the alveolae are obstructed or closed by fragments of the surrounding bone which piece the walls of the alveolae, and all are filled in with the surrounding matrix. The specimen is so fragile that an attempt to remove these obstructions would probably result in serious damage to the skull and mandible. However, in so far as conditions permitted, the teeth have been fitted to their respective alveolae where present.

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[82] Dal Piaz, G., Palaeontographica Italica, Pisa, vol. 6, pl. 26, fig. 3, 1900.

The second lower molar (pl. 7, fig. 3) on the right side is characterized by a high and pointed crown which lacks accessory cusps on the anterior margin. The enamel surface exhibits the same ornamentation as the other molars. The posterior margin bears two closely appressed accessory cusps. The roots are long and at the base are connected by a short thin isthmus. The posterior root projects more downward than backward, and the anterior root recurves distally.

In considering the premolars certain features are apparent at first glance. The crowns are shorter and the roots approximate each other more closely than in the molars. They are characterized by high compressed crowns and are provided with sawlike cutting surfaces on the anterior and posterior edges. One of these, the fourth upper premolar on the left side (pl. 7, fig. 5), bears two well-defined cusps on the posterior margin. The roots of the premolars are connected by a thin isthmus of varying extent. In the above-mentioned tooth the distal one-third of the anterior root is free, while only the very tip is not so united in the fourth right lower premolar (pl. 7, fig. 7). The curvature of the crown and the appearance of the enamel of the third right lower premolar (pl. 7, fig. 6) is essentially the same as the others.

The posterior roots of the premolars tend to become bent backward. The roots are relatively very long, and the oblique position they assume in the alveolae of the shallow jaws does not allow a deeper implantation than the inferior dental canal, and in consequence the ends of the posterior roots are forced to assume a horizontal position.

Four teeth (pl. 8, figs. 1–4) remain to be discussed. Notwithstanding the general resemblance of these teeth to the incisors, there appears some difficulty in deciding whether one or more may not represent a canine tooth. They all possess compressed and slightly recurved crowns. The enamel is longitudinally striate and the cutting surfaces are sharp edged. The roots are long and curve backward. A close examination of the curvature of these four teeth and a comparison of the positions they assumed when inserted in the alveolae of the skull and mandible resulted in assigning three of them to the upper jaws. If this determination is correct, then one (pl. 8, fig. 1) probably represents a lower canine tooth.

VERTEBRAE.

Five vertebrae were found associated with the skull and mandible. Of these two are dorsals, the others lumbars; all of the vertebrae lack epiphyses. Six epiphyses (pl. 13, figs. 3–4; pl. 14, figs. 1–2; pl. 15, figs. 1–2) were found embedded in the matrix. The vertebrae are very soft and porous, and were with difficulty extracted from the matrix.

The dorsals differ noticeably from those of *Delphinodon* and to a less extent from those of *Eurhinodelphis*. A comparison of these vertebrae with the dorsal series of *Inia geoffrensis* shows that one (pl. 9, figs. 1–3) unquestionably represents one of the more anterior dorsals; the other belongs near the end of the series. The structural peculiarities and the general appearance of the anterior dorsal suggest the second dorsal. If this determination is correct, then certain peculiar features are accentuated. Using the length of the centrum as a basis for allocation, this vertebra would be placed fourth or fifth in the dorsal series. However, the position of the articular facet for the head of the rib and the small size of the anterior facets for the postzygapophyses of the preceding vertebra would place the vertebra anterior to the fourth dorsal.

It differs from an anterior dorsal of *Eurhinodelphis* in having a longer neural spine, a relatively larger neural canal, lighter neural arches, and in the possession of a deep groove on the lower half of the posterior face of the neural spine. The anterior dorsals of *Inia geoffrensis* also possess neural spines with similar grooves.

The centrum, including the epiphyses, was nearly as thick as broad. The neural canal is large and rounded, almost as large as the centrum. The zygapophyses are not developed as distinct processes, but are limited to articular surfaces for the corresponding processes of the adjoining vertebrae. The anterior facets are situated on the internal margins of the neurapophyses and the posterior on the ventral faces of the same arches.

The transverse processes or diapophyses are short and blunt, directed outward and slightly forward. The neural spine is broken superiorly.

The other dorsal vertebra (pl. 10, figs. 1–3) to be discussed occupied a more posterior position in the series than the preceding. The transverse processes are shortened and are so situated that their long axes are in a line with the top of the centrum. Each process bears a facet for the head of a rib. In *Inia geoffrensis* the facet for the head of the rib shifts from the anterior margin of the neural arch on the first dorsal to the top of the centrum on the eleventh dorsal. This feature occurs also in other cetaceans, and if any reliance can be placed on it then this vertebra is the eleventh in the dorsal series. The twelfth dorsal of *Inia* bears a facet on the tip of the flattened transverse process and the tenth exhibits the line of fusion of the diapophysis with the parapophysis.

The facets for the post zygapophyses of the preceding vertebra are large and well developed, sloping obliquely internally and ventrally. The prezygapophyses have been broken off but were, apparently, large processes. The neural canal is much smaller than that of the anterior dorsal. An increase in the depth as well as length of the centrum should be noted.

The three lumbars found with the skull are imperfectly preserved. The first and second lumbar vertebrae (pl. 11, figs. 1–2; pl. 12, figs. 1–2; pl. 13, figs. 1–2) possess complete neural arches and the lower portion of the neural spine. The neural arch does not occupy the full length of the centrum and the posterior margins of the arch are strongly concave. The prezygapophyses were large as originally preserved but in the vertebrae under discussion only the broken edges reveal their former presence. The transverse processes are thin and are narrower than the centrum. The distal ends of all are broken or damaged in some way. The neural canal is narrow and high. The third lumbar is so badly damaged that little can be said concerning it.

RIBS.

The number of pairs of ribs possessed by this squalodont can not be determined definitely from the material at hand, which is limited to 10 ribs. It appears, however, that there were present originally at least 11 pairs of ribs. The whole ribs and fragments were carefully compared with associated skeletons of living cetaceans and the following determinations are advanced tentatively.

A considerable portion of the first rib (pl. 16, fig. 1) belonging to the left side is preserved. It is relatively thin, broad, and somewhat flattened, and the curvature at the broken end indicates that it was slightly expanded distally. The articular facets on the head and the tubercle are present but are poorly defined. The neck is relatively narrow. The proximal portion is bent at right angles to the shaft and the neck is turned inward. The left rib (pl. 16, fig. 2) of the second pair of ribs is in a better state of preservation than some of the others and the shaft is more nearly of equal width throughout. The tubercle is well developed, the neck shortened, and the shaft slightly thickened. The distal end is rounded and the surface for the sternal cartilage is lightly pitted. The third rib (pl. 16, fig. 3) belonging to the left side shows a narrowing of the neck and a slight reduction in the extent of the tubercle. The curvature of the shaft is more even, and the angle is not so noticeable as in the first and second ribs.

The rib which is assumed to represent the fourth on the right side (pl. 16, fig. 8) exhibits a noticeable lengthening of the neck and a narrowing of the head. A well-defined facet represents the tubercle. There is a marked lengthening of the shaft. A shortening of the neck which accompanies the uplifting of the head tends to impart a more even curvature to the shaft of the fifth rib (pl. 16, fig. 4) on the left side. The angle formed by the neck with the shaft is most noticeable in the first rib as remarked above and becomes less acute in each succeeding rib. The shaft in the region of the tubercle is considerably narrower than the third and slightly less than the fourth rib. This narrowing of the rib in the region of the tubercle and shortening of the neck is carried even further in the sixth rib (pl. 16, fig. 5) belonging to the left side. The eleventh rib (pl. 16, fig. 6) resembles in some respects the same rib of *Inia geoffrensis*. The shaft is a little wider than some of the preceding ribs. The head is squarely truncated; the shaft is expanded near the center of the proximal half and the distal end is so twisted that it is at right angles to the proximal end of the shaft.

ULNA.

In general outline, the ulna (pl. 6, fig. 2) differs somewhat from that of *Basilosaurus cetoides*.[83] The shaft is proportionately shorter; the olecranon process and the proximal end of the ulna beyond the open greater sigmoid cavity are relatively smaller. This cavity on the anterior face of the ulna possesses an indistinct margin superiorly and the slope of the articular surface would permit considerable freedom of movement of the paddle. The olecranon process is not perfectly preserved, and what remains of the original surface is sufficient to justify the assumption that the original form was essentially similar. On the anterior face of the ulna and immediately below the sigmoid cavity is a depressed articular surface for the corresponding portion of the radius. The shaft of the ulna is relatively stout, quite broad, and thin. The anterior face of the shaft is rounded; the external and internal faces converge posteriorly to form a thin margin. The surface of the bone is smooth and the distal end is squarely truncated.

MEASUREMENTS FOR THE SKULL.

	mm.
Total length of skull as preserved	750
Length of rostrum as preserved (maxillary notch to tip of beak)	485
Greatest breadth of skull across supraorbital processes	270
Greatest breadth of skull across zygomatic processes of squamosal	290
Vertical height of skull (between tip of descending free plate of basioccipital and frontals on the vertex of the skull)	174
Vertical height of skull (basisphenoid to frontals on vertex of skull)	123
Greatest height of skull at base of rostrum (across maxillary notches)	76.5
Total length of maxillae as preserved	578
Greatest breadth across premaxillae at line of anterior margin of mesethmoid	90
Greatest breadth across premaxillae at line of anterior margin of nasals	68

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[83] Gidley, J. W., Proc. U. S. Nat. Mus., vol. 44, No. 1975 fig. 1, p. 651, 1913.

Greatest breadth across premaxillae at narrowest portion of rostrum	19
Greatest breadth of right premaxilla in front of mesethmoid	36
Greatest breadth of right premaxilla at distal end as preserved	16. 5
Narrowest breadth of right premaxilla near middle of rostrum	10±
Breadth of rostrum at maxillary notch	134
Breadth of rostrum at narrowest point	50
Breadth across rostrum at swelling in front of maxillary notch	125
Length of right frontal plate of maxilla (maxillary notch to supraoccipital)	166
Greatest breadth of right frontal plate of maxilla	70±
Least distance across vertex of skull between inner margins of maxillae	58
Greatest length of left supraorbital process of frontal	108
Greatest thickness of preorbital portion of right supraorbital process	28
Least breadth of cranium between temporal fossae	121±
Distance from vertex to upper margin of foramen magnum	123
Height of foramen magnum (crushed)	36+
Greatest breadth across occipital condyles	95
Greatest diameter of right condyle	50
Distance across skull between outer margins of exoccipitals	235
Greatest diameter of zygomatic process of right squamosal	106
Greatest diameter of zygomatic process of left squamosal	108
Distance between tip of right zygomatic process and postorbital portion of supraorbital process	42
Distance between tip of left zygomatic process and postorbital portion of supraorbital process	64
Distance between anterior margin of apophysis of supraorbital process of frontal and posterior margin of right condyle	281
Distance between anterior margin of apophysis of supraorbital process of frontal and posterior margin of left condyle	292
Greatest breadth of basioccipital across tips of descending free plates	112. 5
Distance between anterior margin of foramen magnum and anterior margin of basisphenoid	93
Greatest superior breadth of supraoccipital	150
Total length of vomer as preserved	417
Total length of vomer, estimated	440
Greatest length of right nasal	21
Greatest breadth of right nasal	28
Greatest length of exposed portion of right frontal on vertex of skull	31
Greatest breadth of exposed portion of right frontal on vertex of skull	31

MEASUREMENTS FOR THE MANDIBLE.

Length of mandible as preserved	604
Depth of mandible at coronoid	152
Least depth of mandible at alveolus for third lower premolar	36
Least breadth of tooth-bearing portion of the mandible	19. 5
Greatest breadth of tooth-bearing portion of the mandible	27
Depth of mandible at level of last molar	53

MEASUREMENTS FOR THE PERIOTIC.

Greatest length of periotic (tip of anterior to tip posterior process)	41. 5
Greatest depth of labyrinthic region of periotic	15. 5
Greatest breadth of labyrinthic region of periotic	21. 3

MEASUREMENTS OF TEETH.

	Last lower molar, right (pl. 7, fig. 1).	Second upper molar, left (pl. 7, fig. 2).	Second lower molar, right (pl. 7, fig. 3).	Second upper molar, right (pl. 7, fig. 4).	Fourth upper premolar, left (pl. 7, fig. 5).	Third lower premolar, right (pl. 7, fig. 6).	Fourth lower premolar, right (pl. 7, fig. 7).
	mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
Total length in a straight line (apex of crown to tip longest root as preserved)	33	47.7	58.8	52+	52.2	45+	63.4
Length of crown	21.6	23.6	22	22±	17.7	17.4	16.7
Greatest diameter of tooth below crown	23.2	21.2	21.7	20.2	17.3	16.7	16.5
Greatest height of crown in straight line	13.7	20.8	21.9	21.3	19.5	19.6	19.9
Greatest breadth of crown	9.6	12	10.5	11.7	10.2	9.6	9.5

	Lower canine (pl. 8, fig. 1).	Upper incisor (pl. 8, fig. 2).	Upper incisor (pl. 8, fig. 3).	Upper incisor (pl. 8, fig. 4).
	mm.	*mm.*	*mm*	*mm.*
Total length in a straight line (apex of crown to tip longest root as preserved)	90.5	78.3	74	75+
Length of crown	14.6	15±	13.5	16±
Greatest height of crown in straight line	27	26.6	26	26
Greatest breadth of crown	10.2	10.3	10.2	10.5
Greatest diameter of tooth below crown	14.5	14.6	13.5	14.4

MEASUREMENTS OF ULNA.

	mm.
Greatest length of ulna	100
Transverse diameter of ulna at lower margin of greater sigmoid cavity	25
Antero-posterior diameter of ulna at lower margin of greater sigmoid cavity	55.6
Transverse diameter of olecranon	14
Transverse diameter of ulna at distal end	17.7
Antero-posterior diameter of ulna at distal end	29.5+

MEASUREMENTS OF VERTEBRAE.

	Anterior dorsal.	Eleventh dorsal.	First lumbar.	Second lumbar.
	mm.	*mm.*	*mm.*	*mm.*
Greatest depth (vertically) of vertebra as preserved (tip of neural spine to inferior face of the centrum)	133	136	134	134
Greatest breadth of spinal canal posteriorly	39	23.5	21	25
Greatest depth of spinal canal anteriorly	38	31	35.5	38
Median depth of spinal canal posteriorly	41	30.5	42	38
Depth of centrum posteriorly	36.5	45.3	49	53
Breadth of centrum posteriorly	55	57	61	68
Length of centrum without epiphyses	37	51	58	60
Distance across vertebrae between tips of the transverse processes (parapophyses)	X	79+	184	178
Distance across vertebrae between tips of prezygapophyses (external measurements)	X	31.5	X	X
Vertical height of neural spine as preserved (distance between superior margin spinal crest and tip of spine)	57	60	48.5	46.5
Distance across vertebrae between tips of the diapophyses as preserved	104+	X	X	X
Distance between tip of right postzygapophysis and tip of right prezygapophysis	X	78	X	X
Minimum length of neuropophysis	38	34	35.5	42
Antero-posterior breadth of neural spine in a horizontal line immediately above the zygapophyses	45	57	52	57

REMARKS ON AN UNDETERMINED SQUALODONT OF LARGE SIZE FROM THE CALVERT CLIFFS, MARYLAND.

SQUALODON, species indeterminate.

In the course of several years desultory collecting along the Calvert Cliffs a number of interesting cetaceans have been found. The late F. W. True instigated most of the collecting and encouraged William Palmer and David B. Mackey to make trips along the western shore of Chesapeake Bay. No systematic search was ever made for cetacean remains, but, nevertheless, in this way a miscellaneous collection of fossil cetaceans was built up. A number of skulls in a fair state of preservation were thus obtained, and, in addition to these, large numbers of unassociated vertebrae and teeth. In sorting over this material a number of fragments that pertain to at least two types of squalodonts were found. The smaller one of these is apparently the same as the species described in the present paper. The other represents a larger form which may possibly belong to a previously described squalodont, and in want of more complete material the writer has deferred naming the specimen. In view of the scarcity of squalodonts in North American Tertiary deposits it seems advisable to describe and figure some of the fragments and teeth which have been found. It has been known for some time that a large squalodont existed during the Calvert Miocene, but until recently all that was known concerning it consisted of a few broken teeth. In 1908 a double-rooted molar tooth of large size, but lacking most of the crown, was found adhering to a fragment of the maxilla by Mr. Mackey. This tooth and the other fragments hereinafter described were acquired by purchase from Mrs. W. Palmer.

Specimen, No. 10694, Division of Vertebrate Palaeontology, United States National Museum.—The material consists of one molar and a fragment of a maxilla.

Occurrence.—One mile south of Chesapeake Beach, Calvert County, Maryland, near latitude 38° 40′ and longitude 76° 32′; shown on Patuxent Quadrangle or Patuxent Folio, No. 152, United States Geological Survey.

Horizon.—This specimen was collected by David B. Mackey on July 4, 1908. It was found in the water in freshly fallen beach talus débris which, apparently, was derived from Shattuck's zone 10 of the Calvert Miocene formation of Maryland.

This large two-rooted molar is characterized by swollen roots which have a thick outer layer of cementum that flakes off when subjected to erosion. This layer is thickest near the tips of the roots and becomes thinner near the enamel crown. The dentine of the anterior root is exposed on the external side(pl. 17, fig. 1*b*); it is dark brown in color. The posterior root was accidently broken and the cross section shows a solidified core or tooth pulp perforated by a minute channel for the nerve. In this section the cementum and the dentine are approximately equal in thickness while the diameter of the pulp cavity is fully twice the width of either of the above layers.

The roots are joined at the base by a short thin isthmus which is continued upward as a well-defined groove and terminating below the crown. The posterior root is stouter than the anterior. The enamel crown of the molar is ornamented with longitudinal striae; these striae are more pronounced on the external margin than on the internal. The apex of the crown is missing and the posterior cutting edge is incomplete. The worn surfaces of the enamel indicate that three cusps were originally present on the posterior edge though they were worn down to their bases. The anterior cutting edge is missing.

The fragment of the jaw (pl. 17, fig. 1*c*) which held this molar is so worn that little information can be obtained regarding its former appearance. It possesses two alveolae for two-rooted molars. The curvature of the outer surface of this fragment suggests that it may be a portion of the left maxilla.

MEASUREMENTS FOR MOLAR AND FRAGMENT OF JAW.

	mm.
Greatest length of crown	29
Greatest breadth of crown	15. 2
Greatest diameter across combined roots below crown	36. 3
Greatest thickness of posterior root	17. 7
Greatest width of posterior root	18. 5
Length of posterior root measured in a straight line from center of base of crown to tip	60. 5
Length of anterior root measured in a straight line from center of base of crown to tip	58
Distance from base of enamel crown to outer edge of alveolae	15
Greatest length of fragment of jaw	94
Greatest depth of fragment of jaw	39

A nearly perfect crown of a large molar (pl. 17, figs. 2*a*, 2*b*) was obtained by William Palmer on one of his trips to Chesapeake Beach. Reference is made to a number of broken molar teeth in Mr. Palmer's notes, but the teeth are not described in such a way that one can identify them. According to these notes all the teeth were obtained from beach débris and hence there is no means of associating the specimens with any particular zone.

Specimen, No. 10726, Division of Vertebrate Palaeontology, United States National Museum.

Occurrence.—Chesapeake Beach, Calvert County, Maryland.

The molar crown is high and the enamel is rugose, the striae being coarser at the base than at the apex. There are three accessory cusps on the posterior edge. The anterior edge is missing but there are no peculiarities which would suggest the existence of accessory cusps. The external layer of cementum has flaked off and the exposed dentine is black in color.

MEASUREMENTS FOR THE MOLAR.

	mm.
Greatest length of crown	30.7
Greatest breadth of crown	14.4
Greatest height of crown (as preserved)	25.

In 1916 Mr. Palmer found a number of fragments of this large squalodont a few days after a hundred tons or more of the cliff had fallen on the beach. A manuscript note of Mr. Palmer found with the fragments states that rough weather prevented three further attempts to examine the talus material. He thought it was probable that more of the skeleton was present as most of the fractures were recent and it indicated that the skull was broken up by the fall.

Specimen, No. 10695, Division of Vertebrate Palaeontology, United States National Museum.—This material consists of 20 fragments of a skull and mandible; a total of 17 alveolae can be counted in the fragments of the upper and lower jaws. Four teeth were found in the beach débris in the immediate vicinity of these fragments.

Occurrence.—On the western shore of Chesapeake Bay, near South Chesapeake Beach, Calvert County, Maryland, near latitude 38° 40′ and longitude 76° 32′; shown on Patuxent Quadrangle or Patuxent Folio, No. 152, United States Geological Survey.

Horizon.—The fragments were discovered by William Palmer during March, 1916. They were found on the shore at the water edge of a freshly fallen talus and were evidently from the upper brownish part of the cliff, or near the top of Shattuck's zone 9. The top of zone 9 has been considerably eroded at this point. Shattuck's zone 10 is quite different in appearance, and thus the fragments may be assigned to zone 9 of the Calvert Miocene formation of Maryland.

Notwithstanding the small size of this tooth (pl. 18, figs. 1*a*, 1*b*) there appears to be some justification for assuming that it belongs to the same type of squalodont as the molar discussed above. The base of the enamel crown is coarsely striate and the root is proportionately stouter than similar teeth of *Squalodon calvertensis*. The proportions of the tooth, the shape, curvature, and appearance of the enamel crown are in no way suggestive of *Squalodon calvertensis*.

MEASUREMENTS FOR THE PREMOLAR.

	mm.
Greatest length of crown	15.6
Greatest breadth of crown	9.2
Greatest length of tooth (as preserved) measured in a straight line	64.7

A distal fragment of the left maxilla possessing three single-rooted alveolae suggests a long slender rostrum for this squalodont. The fragment is subtriangular in cross section. On the internal side (pl. 18, fig. 3*a*) and slightly above the palatal face there is a distinct groove which presumably receives the anterior extension of the vomer. Above this groove the surface slopes obliquely upward and the roughened surface of this face indicates the line of contact with the premaxillae.

MEASUREMENTS FOR THE FRAGMENT OF MAXILLA.

	mm.
Length of fragment of maxilla	178.7
Breadth of fragment of maxilla at anterior end	35
Breadth of fragment of maxilla at posterior end	35.6
Depth of fragment of maxilla at posterior end	37
Antero-posterior diameter of first alveolus	29
Transverse diameter of first alveolus	18.2
Antero-posterior diameter of septum between first and second alveolae	19.2

Alveolae for seven teeth, four of which were two-rooted and three one-rooted, are present in the fragment of the left mandible (pl. 19, fig. 1*a*). The roughened internal surface of the ramus indicates a very long symphysis which terminated proximally near the alveolus for the third two-rooted tooth. An examination of the alveolae shows that the first and second alveolae contained single-rooted teeth, while the third at the time of discovery possessed a crownless tooth. This premolar was two-rooted, but the roots, with the exception of the tips, were joined throughout their length by a thin isthmus. Impressions made by maxillary teeth are to be observed between the alveolae for the posterior premolars. In the alveolae for the first and second two-rooted teeth, the septa which fit between the roots begin at least 7 mm. below the level of the superior face of the ramus, while those in the posterior alveolae extend the full length. On the external face of the mandible there are six foramina opening into the channels that lead anteriorly (pl. 19, fig. 1*b*). The more anterior foramina are nearer the inferior margin, while the posterior ones approximate the superior margin.

MEASUREMENTS FOR THE FRAGMENT OF MANDIBLE.

	mm.
Length of fragment of mandible	367
Vertical depth of proximal end of fragment	58
Vertical depth of distal end of fragment	41.5
Vertical depth of fragment near center	50
Length of perfect septum	22

The squamosal is not complete but what is preserved exhibits some unusual features. In its general form, the squamosal resembles other previously described squalodonts; the massive zygomatic process and the relatively small glenoid fossa are suggestive of *Squalodon bariensis*. It differs, however, in many respects from that species. The zygomatic process is stout, tapering anteriorly as seen from the dorsal view, but rather deep dorso-ventrally. The superior margin does not rise abruptly above the exoccipital and presents an irregular outline. The postglenoid process is a strong ventrally projected plate of bone whose posterior face is grooved by the external auditory meatus and whose anterior face is continuous with the glenoid fossa. The process is rather broad and terminates in a rounded tip.

When viewed from the ventral side (pl. 20, fig. 1*a*) the glenoid surface is seen to be strongly concave antero-posteriorly and rather narrow from side to side. On the internal and posterior margin of the glenoid fossa there is a shallow cavity measuring approximately 25 by 48 mm., the function of which is uncertain. A third low knoblike process fills in the space between the groove for the external auditory meatus and the exoccipital.

MEASUREMENTS FOR THE SQUAMOSAL.

	mm.
Distance from tip of zygomatic process to tip of postglenoid process	141
Distance from tip of zygomatic process to posterior margin of exoccipital	184
Greatest breadth of glenoid surface	53
Greatest length of glenoid surface	100+

The exoccipital varies greatly in thickness, being massive at the ventro-external border and thin superiorly. The superior margin (pl. 20, fig. 1*b*) is deflected backward and presumably represents the external projection of the lambdoidal crest which follows the curvature of the temporal fossa. Externally the exoccipital is suturally united with the squamosal, the remainder is free, and forms the posterior wall of the periotic recess. A large paroccipital process is formed by the ventral expansion of that portion of the exoccipital adjacent to the knoblike process of the squamosal.

FRAGMENT OF A RIGHT MAXILLA.

Among these fragments is a portion of a right maxilla (pl. 18, fig. 2). In its general form the maxilla was undoubtedly much like the corresponding element in the skull of *Squalodon calvertensis*. Two double-rooted alveolae are present, and these are too small to bear teeth as large as those of the large squalodont discussed previously. The fragments collected by Palmer do not bear any collector's numbers, and it is possible that this fragment of the maxilla was at some time accidentally placed in the tray containing the larger specimen.

EXPLANATION OF PLATES.

Squalodon calvertensis, new species. No. 10484, Division of Vertebrate Paleontology, U. S. National Museum. Calvert formation, western shore of Chesapeake Bay, about 2 miles south of Chesapeake Beach, Calvert County, Maryland. Collected by Norman Boss July 8, 1921.

PLATE 1.

Type skull of *Squalodon calvertensis*, new species. About two-fifths natural size. Dorsal view. The superior margin of the mesethmoid is imperfectly preserved and has been restored in the figure.

The same abbreviations are used on Plates 1 to 4 for the following parts: *Al.*, alisphenoid; *Bo. pl.*, descending free plate of basioccipital; *Bs.*, basisphenoid; *C.*, condyle; *Can. op.*, canalis opticus; *Cr. l.*, lambdoidal crest; *Ex. o.*, exoccipital; *Fo. c.*, condylar foramen; *Fo. lac. med.*[84], foramen lacerum medium; *Fo. lac. post.*, foramen lacerum posterius; *Fo. m.*, foramen magnum; *Fr.*, frontal; *Fs. petr.*, fossa petrosi; *Gl. f.*, glenoid fossa; *La.*, lachrymal; *M.*^{1}-*M.*^{7}, first to seventh molars, inclusive; *Max.*, maxilla; *Meat. aud. ext.*, meatus auditorius externus; *Mes.*, mesethmoid; *N. A.*, external openings of nasal passages; *Na.*, nasal; *Pa.*, parietal; *Pa. p.*, paroccipital process; *Pm.*^{3}-*Pm.*^{5}, third to fifth premolars, inclusive; *Pmx.*, premaxilla; *Po. gl. p.*, postglenoid process; *Po. p.*, postorbital portion of supraorbital process of frontal; *Pr. falc.*, processus falciformis; *Pr. p.*, preorbital portion of supraorbital process of frontal; *Prs.*, the posterior end of the presphenoid is exposed in this open suture in front of the basisphenoid; *Pt.*, external pterygoid; *So.*, supraoccipital; *Sph. f.*, sphenoidal fissure; *Sq.*, squamosal; *Vo.*, vomer; *X.*, internal openings of nasal passages were present at this point originally, but were not preserved in this skull—the region they would occupy having been filled in with plaster of Paris.

PLATE 2.

Type skull of *Squalodon calvertensis*, new species. About two-fifths natural size. Ventral view.

PLATE 3.

Type skull of *Squalodon calvertensis*, new species. About two-fifths natural size. Lateral view. The parieto-squamosal and parieto-frontal sutures indicated in this figure represent the relations existing between these elements on the left lateral wall of the cranium.

PLATE 4.

Type skull of *Squalodon calvertensis*, new species. About two-fifths natural size. Posterior view.

PLATE 5.

Type mandible of *Squalodon calvertensis*, new species. About seven twenty-fifths natural size. Fig. 1*a*, external view; Fig. 1*b*, superior view.

PLATE 6.

FIG. 1. Type mandible of *Squalodon calvertensis*, new species. About seven twenty-fifths natural size. Internal view.

2. Right ulna of *Squalodon calvertensis*, new species. About twenty-one twentieths natural size. External view.

PLATE 7.

Teeth of *Squalodon calvertensis*, new species. About natural size. Fig. 1, posterior lower molar, right side; Fig. 2, second upper molar, left side; Fig. 3, second lower molar, right side: Fig. 4, second upper molar, right side; Fig. 5, fourth upper premolar, left side; Fig. 6, third lower premolar, right side; Fig. 7, fourth lower premolar, right side.

PLATE 8.

Four teeth and a right periotic of *Squalodon calvertensis*, new species. About natural size. Fig. 1, lower canine ?; Figs. 2-4, upper incisors ?; Fig. 5, ventro-internal view of periotic; Fig. 6, internal view of periotic.

PLATE 9.

Anterior dorsal vertebra of *Squalodon calvertensis*, new species. About one-half natural size. Fig. 1, anterior view; Fig. 2, superior view; Fig. 3, posterior view.

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[84] The line leading from *Fo. lac. med.* on plate 2 terminates at an opening which may represent the foramen ovale; it should have been continued inward for 2. mm. or more to a smaller foramen.

PLATE 10.

Eleventh dorsal vertebra of *Squalodon calvertensis*, new species. About nine-sixteenths natural size. Fig. 1, anterior view; Fig. 2, superior view; Fig. 3, posterior view.

PLATE 11.

First lumbar vertebra of *Squalodon calvertensis*, new species. About five-ninths natural size. Fig. 1, anterior view; Fig. 2, posterior view.

PLATE 12.

Second lumbar vertebra of *Squalodon calvertensis*, new species. About five-ninths natural size. Fig. 1, anterior view; Fig. 2, posterior view.

PLATE 13.

Vertebrae of *Squalodon calvertensis*, new species. About five-ninths natural size. Fig. 1, superior view of first lumbar vertebra; Fig. 2, superior view of second lumbar vertebra; Figs. 3–4, epiphyses of vertebrae. Internal views. About natural size.

PLATE 14.

FIGS. 1–2. Epiphyses of vertebrae. Internal views. About natural size.

PLATE 15.

FIGS. 1–2. Epiphyses of vertebrae. Internal views. About natural size.

PLATE 16.

Ribs of *Squalodon calvertensis*, new species. About seven-twentieths natural size. Fig. 1, first rib, left side; Fig. 2, second rib, left side; Fig. 3, third rib, left side; Fig. 4, fifth rib, left side; Fig. 5, sixth rib, left side; Fig. 6, eleventh rib, left side; Fig. 7, sixth ? rib, right side; Fig. 8, fourth rib, right side; Figs. 9–10, posterior ribs, right side.

PLATE 17.

FIGS. 1*a*, 1*b*. Molar tooth of *Squalodon*, species undetermined. About natural size. Fig. 1*c*, fragment of jaw. About seven-ninths natural size. No. 10694, Division of Vertebrate Paleontology, U. S. National Museum. Calvert formation, 1 mile south of Chesapeake Beach, Calvert County, Maryland.

2*a*, 2*b*. Molar tooth of *Squalodon*, species undetermined. About natural size. No. 10726, Division of Vertebrate Paleontology, U. S. National Museum. Chesapeake Beach, Calvert County, Maryland.

PLATE 18.

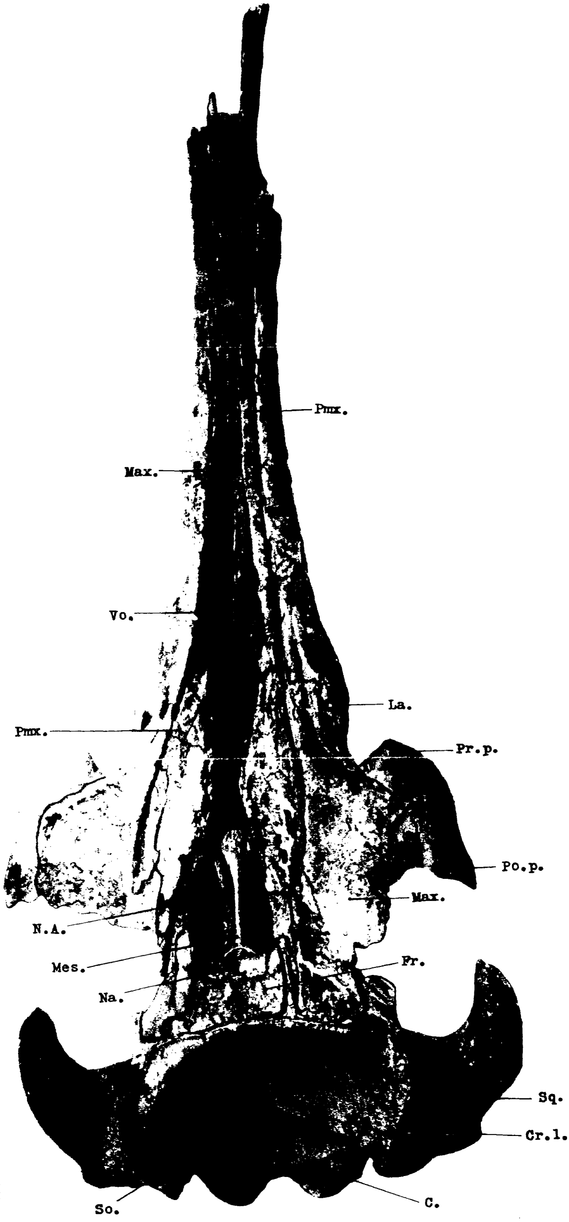
FIGS. 1*a*, 1*b*. Premolar tooth of *Squalodon*, species undetermined. About natural size. Fig. 2, fragment of right maxilla. About thirteen-twentieths natural size. Figs. 3*a*, 3*b*, fragment of left maxilla. About three-fifths natural size. No. 10695, Division of Vertebrate Paleontology, U. S. National Museum. Calvert formation, near South Chesapeake Beach, Calvert County, Maryland.

PLATE 19.

FIGS. 1*a*, 1*b*. Fragment of left mandible of *Squalodon*, species undetermined. About two-thirds natural size. No. 10695, Division of Vertebrate Paleontology, U. S. National Museum. Calvert formation, near South Chesapeake Beach, Calvert County, Maryland.

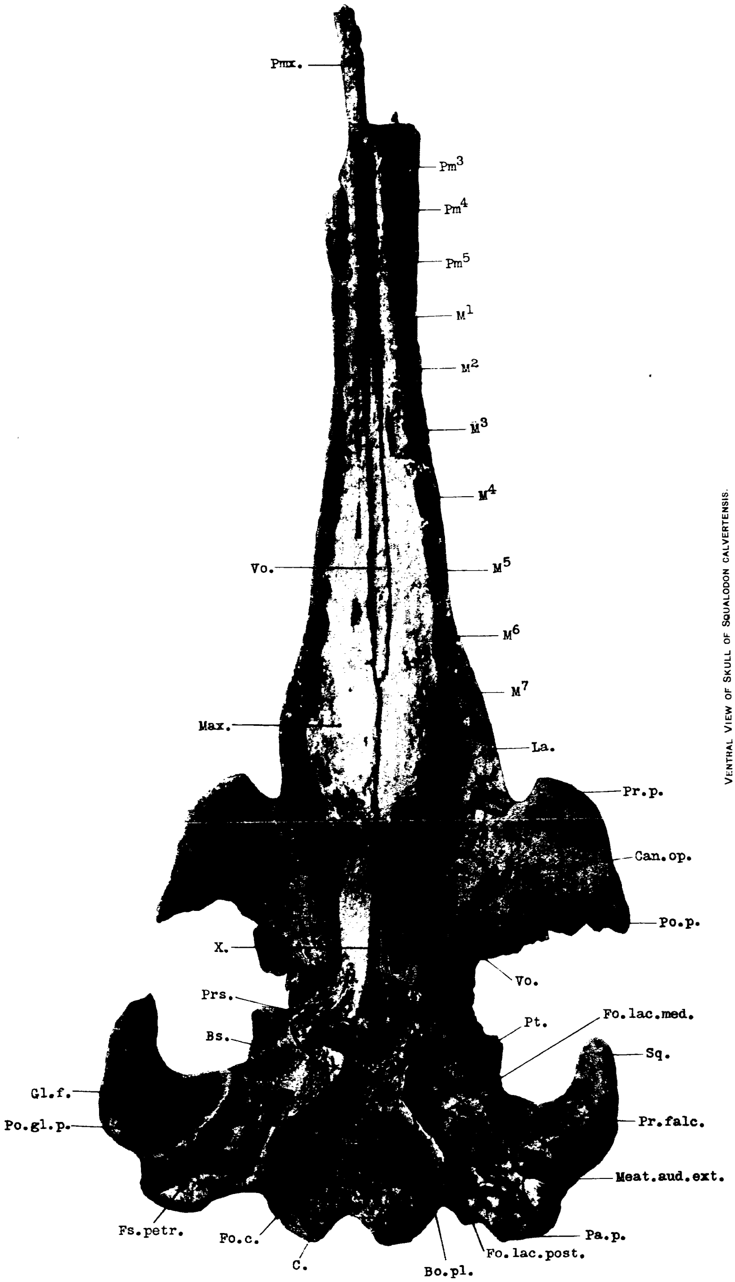
PLATE 20.

FIGS. 1*a*, 1*b*. Left squamosal and adjoining exoccipital of *Squalodon*, species undetermined. About six-tenths natural size. No. 10695, Division of Vertebrate Paleontology, U. S. National Museum. Calvert formation, near South Chesapeake Beach, Calvert County, Maryland.



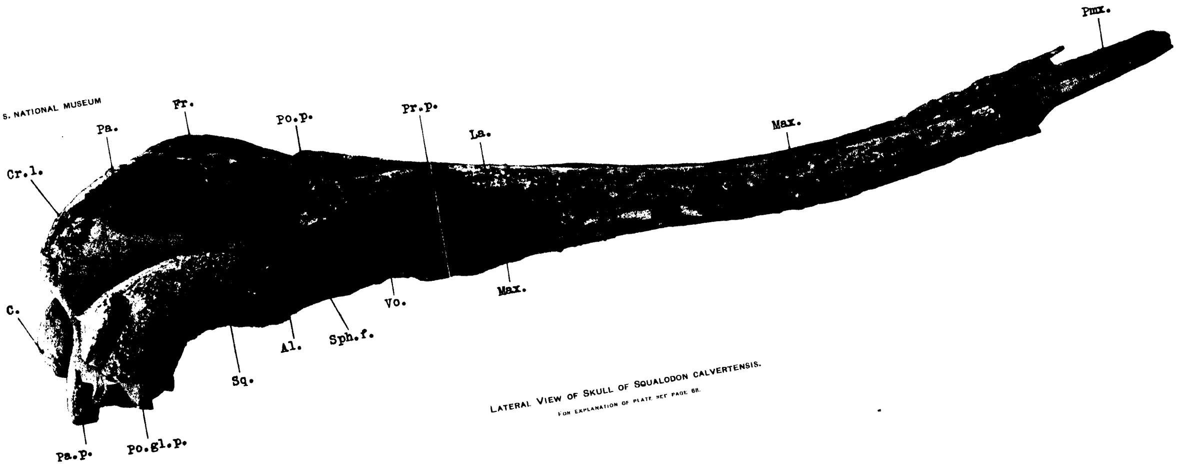
DORSAL VIEW OF SKULL OF SQUALODON CALVERTENSIS.

FOR EXPLANATION OF PLATE SEE PAGES 87, 88



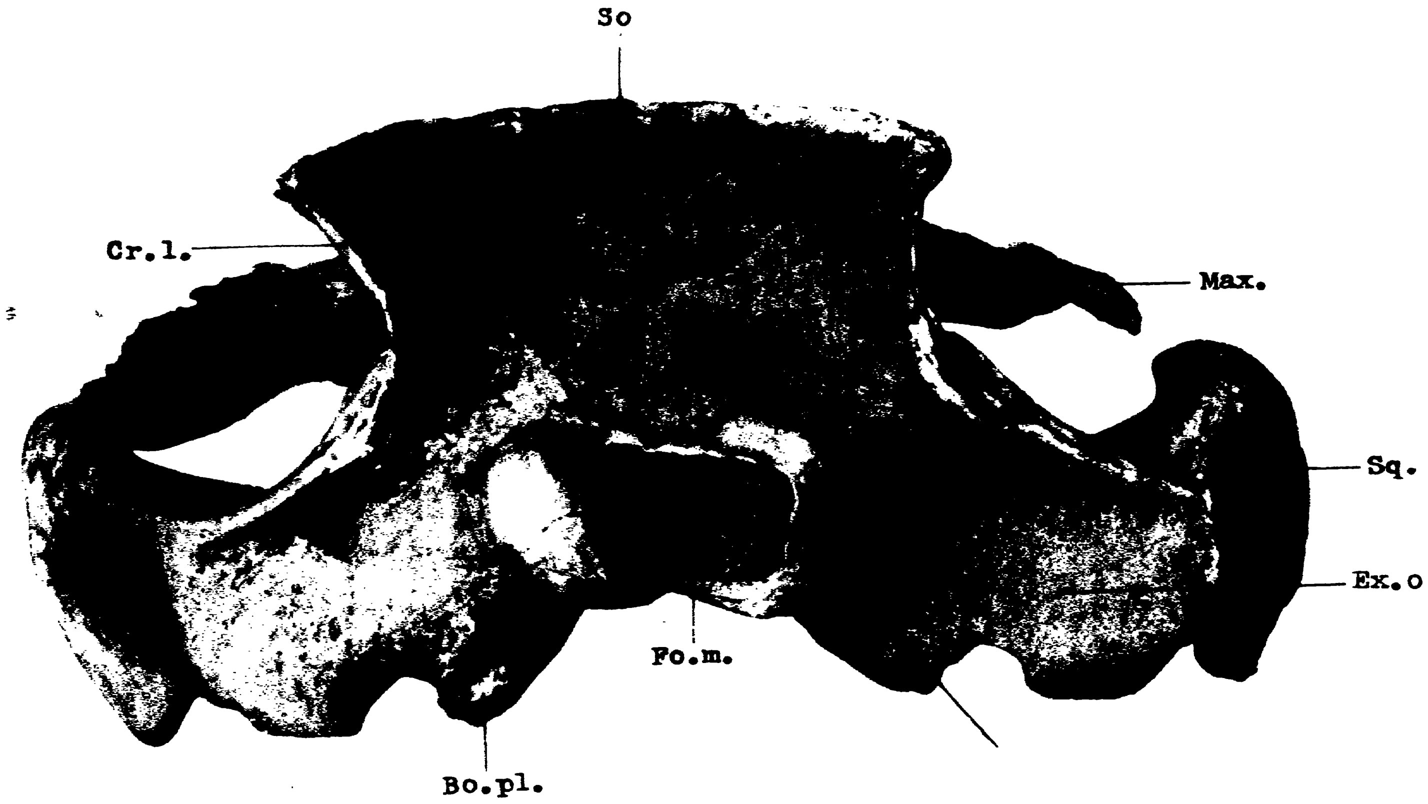
VENTRAL VIEW OF SKULL OF SQUALODON CALVERTENSIS.

FOR EXPLANATION OF PLATE SEE PAGE 66.



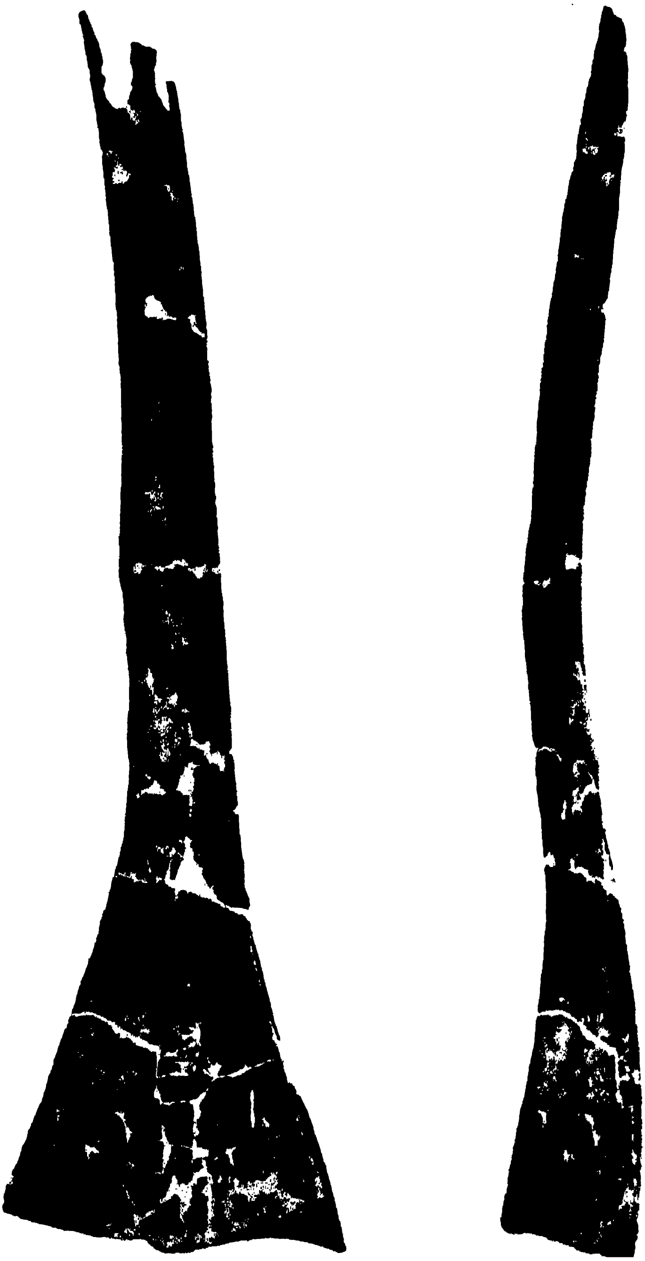
LATERAL VIEW OF SKULL OF SQUALODON CALVERTENSIS.

FOR EXPLANATION OF PLATE SEE PAGE 68.



POSTERIOR VIEW OF SKULL OF SQUALODON CALVERTENSIS.

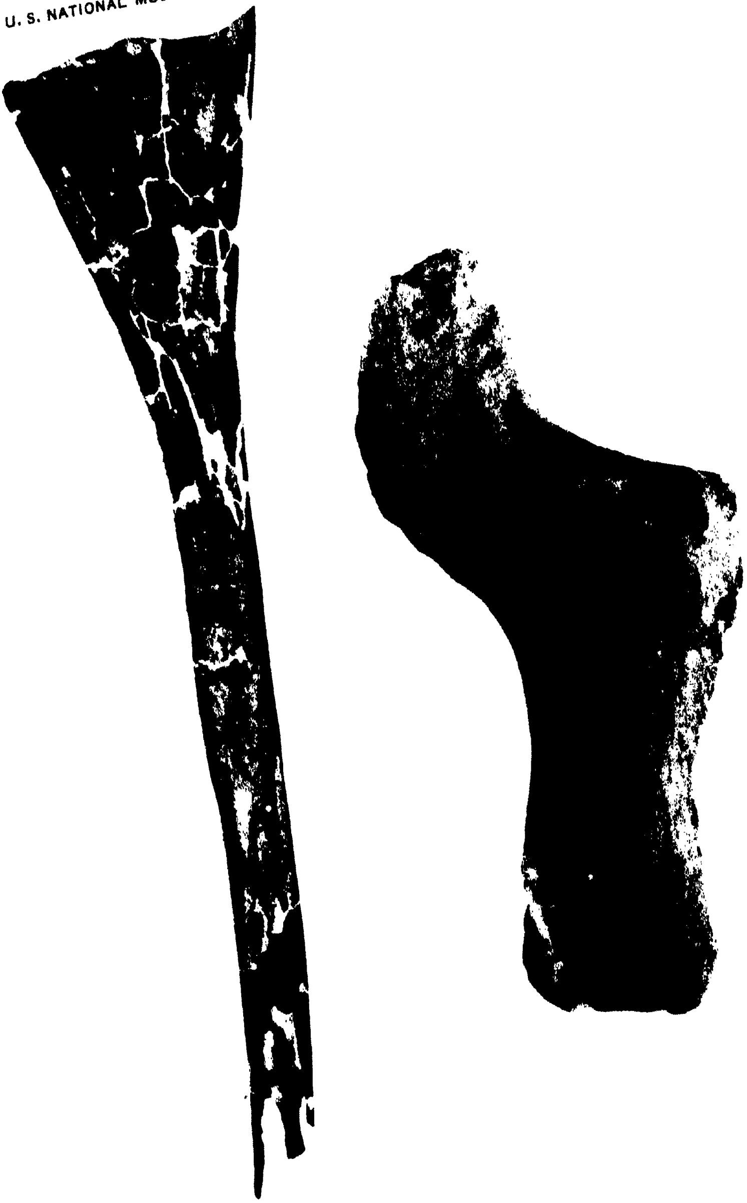
FOR EXPLANATION OF PLATE SEE PAGE 63.



1a 1b

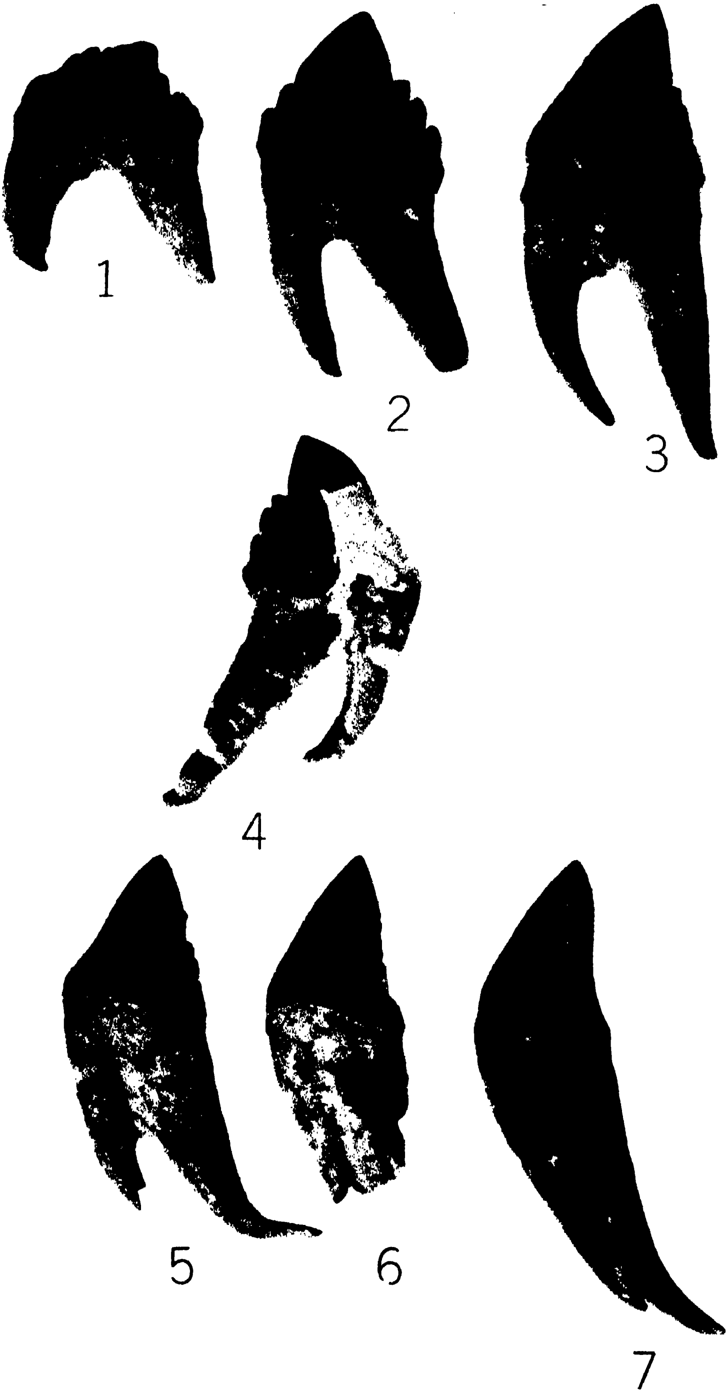
SUPERIOR AND EXTERNAL VIEWS OF MANDIBLE OF SQUALODON CALVERTENSIS.

[SEE PAGE 68.



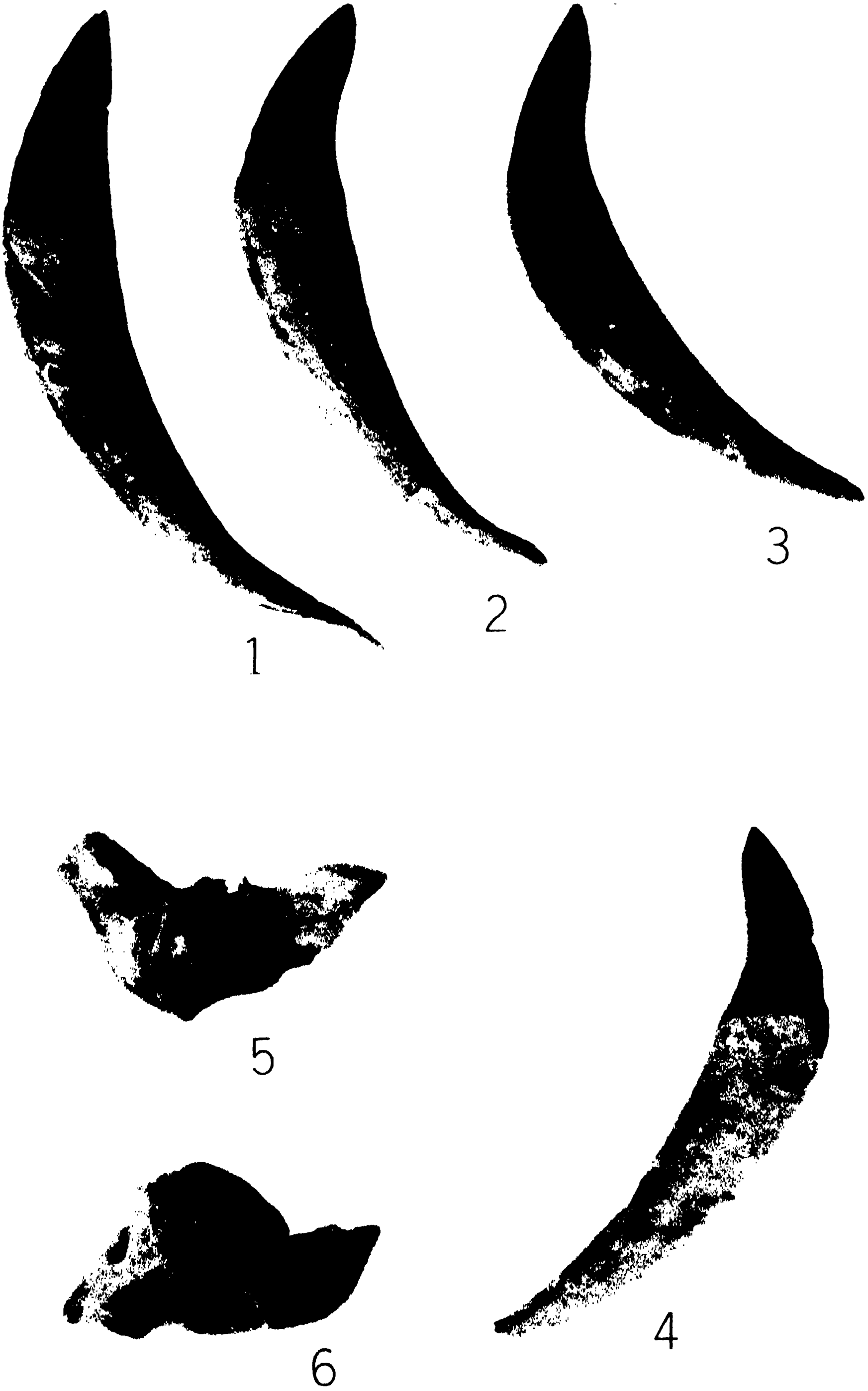
VIEWS OF MANDIBLE AND ULNA OF SQUALODON CALVERTENSIS.

FOR EXPLANATION OF PLATE SEE PAGE 68.



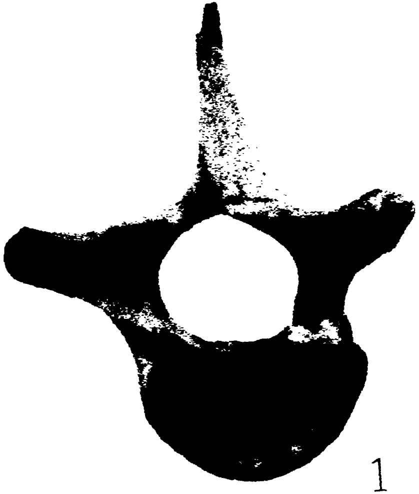
MOLARS AND PREMOLARS OF SQUALODON CALVERTENSIS.

FOR EXPLANATION OF PLATE SEE PAGE 68.



INCISOR-LIKE TEETH AND PERIOTIC OF SQUALODON CALVERTENSIS.

FOR EXPLANATION OF PLATE SEE PAGE 68



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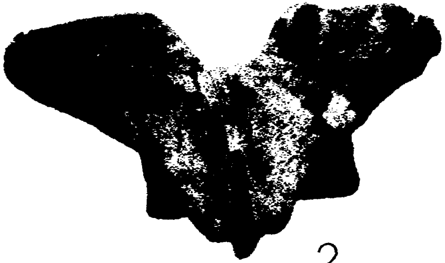

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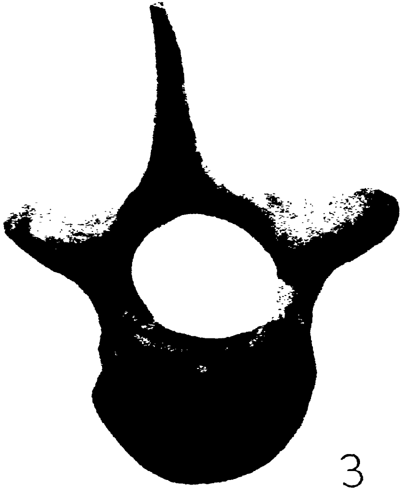
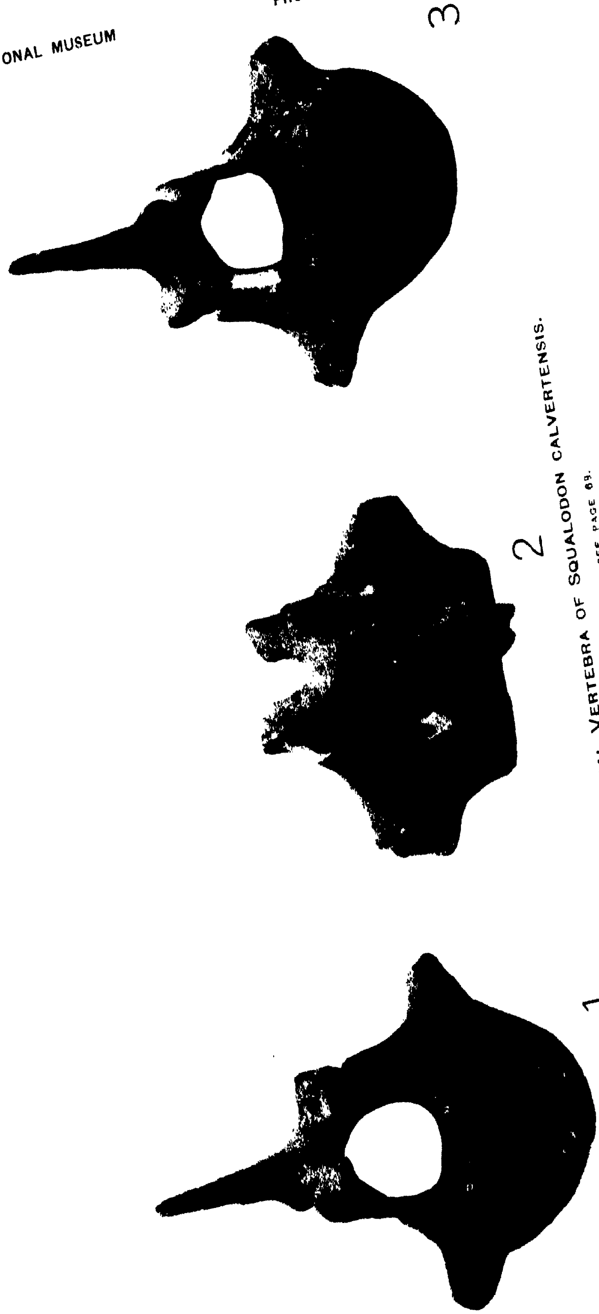


3

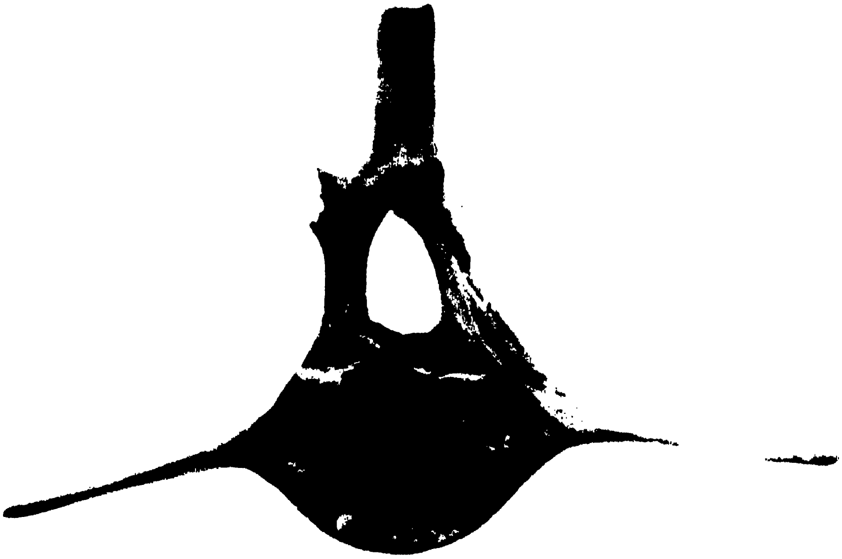
ANTERIOR DORSAL VERTEBRA OF SQUALODON CALVERTENSIS.

FOR EXPLANATION OF PLATE SEE PAGE 68



Eleventh Dorsal Vertebra of Squalodon calvertensis.

For explanation of plate see page 69.



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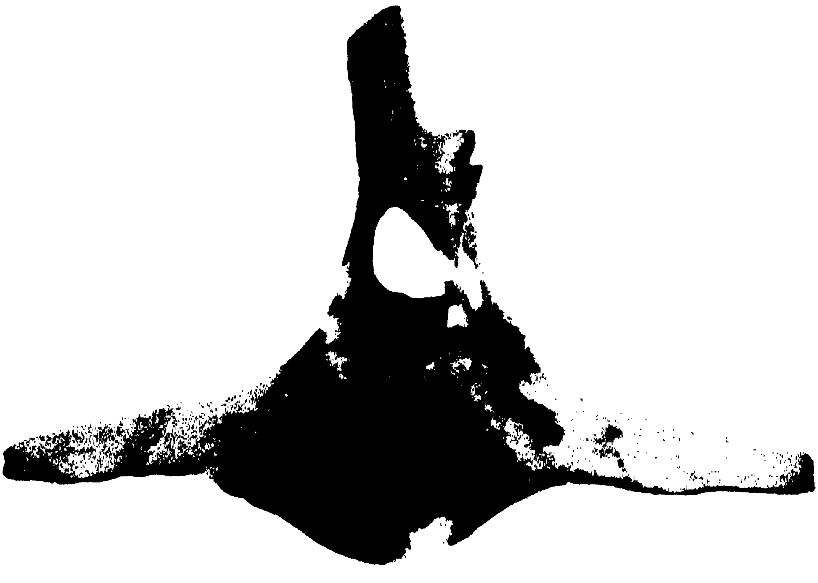
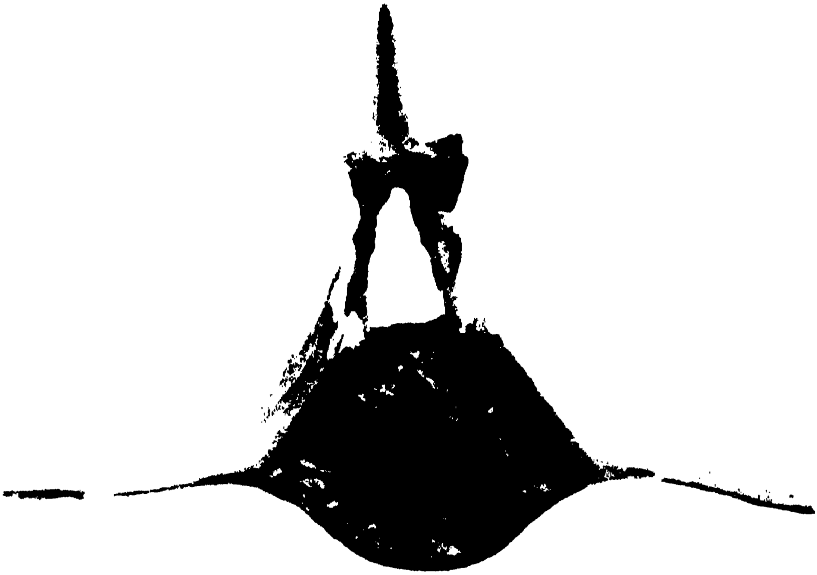


FIRST LUMBAR VERTEBRA OF SQUALODON CALVERTENSIS.

FOR EXPLANATION OF PLATE SEE PAGE 69.



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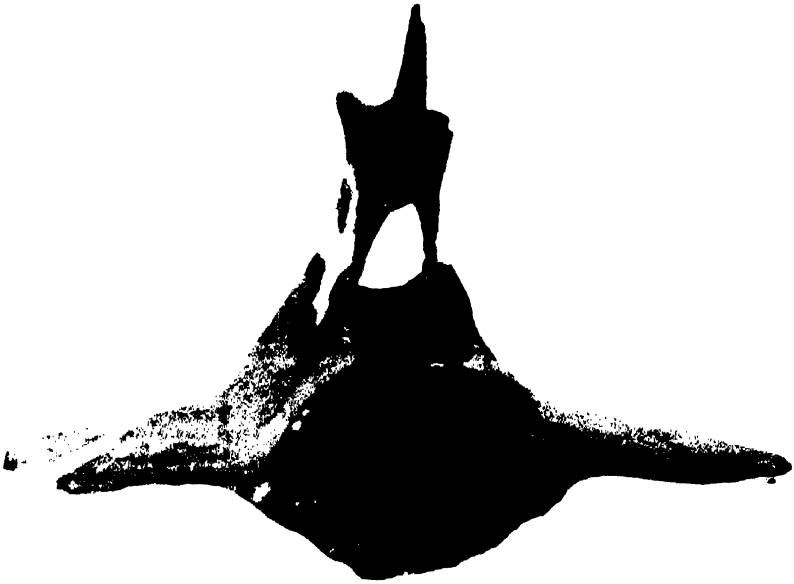
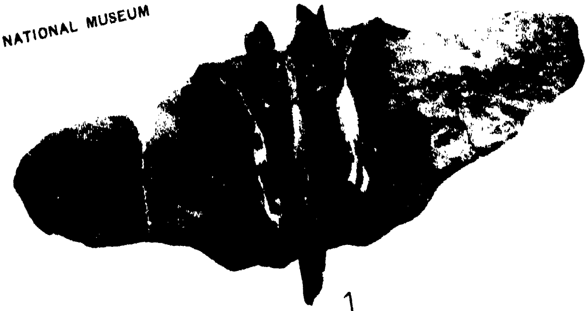


2

SECOND LUMBAR VERTEBRA OF SQUALODON CALVERTENSIS.

FOR EXPLANATION OF PLATE SEE PAGE 69.



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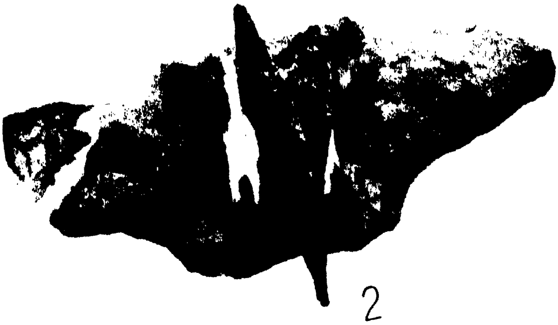

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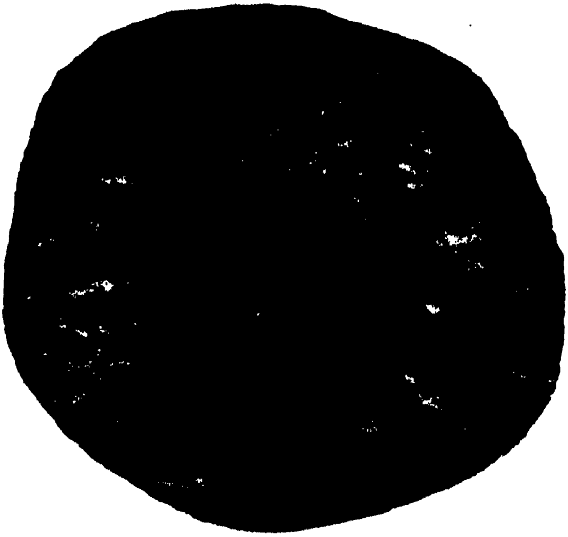
4

EPIPHYSES AND LUMBAR VERTEBRAE OF SQUALODON CALVERTENSIS.

FOR EXPLANATION OF PLATE SEE PAGE 69.



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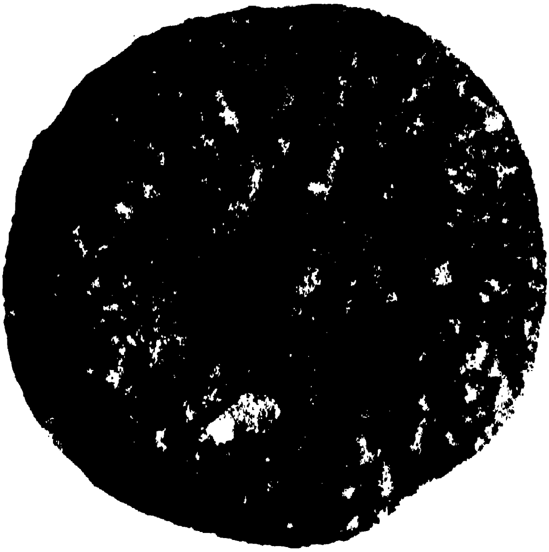
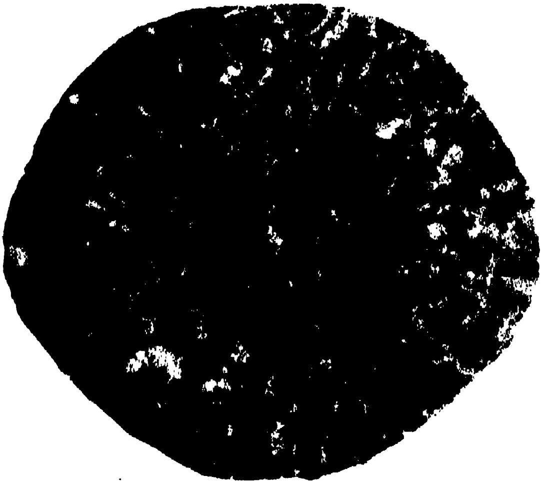
EPIPHYSES FROM VERTEBRAE OF SQUALODON CALVERTENSIS.

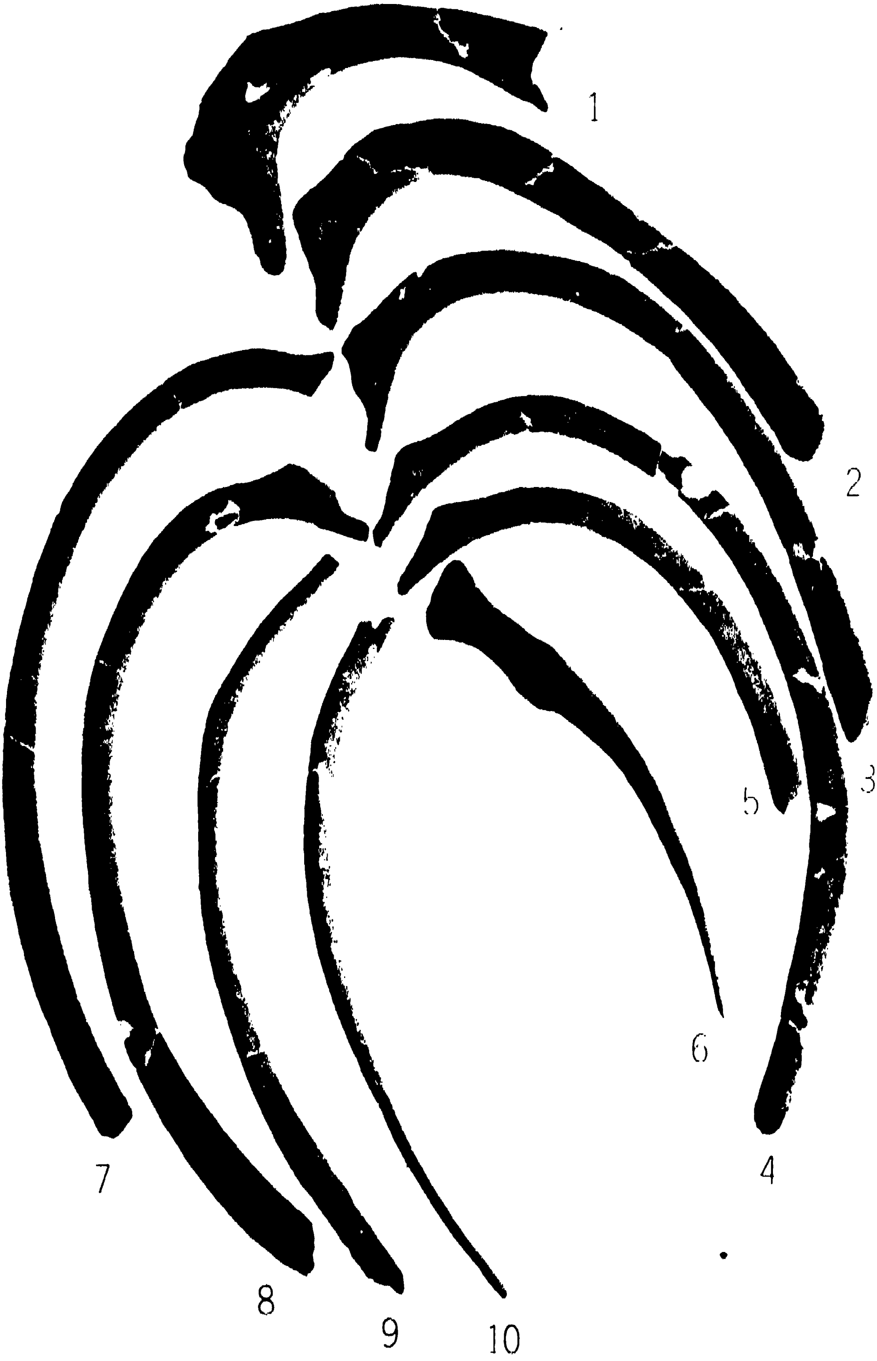




2

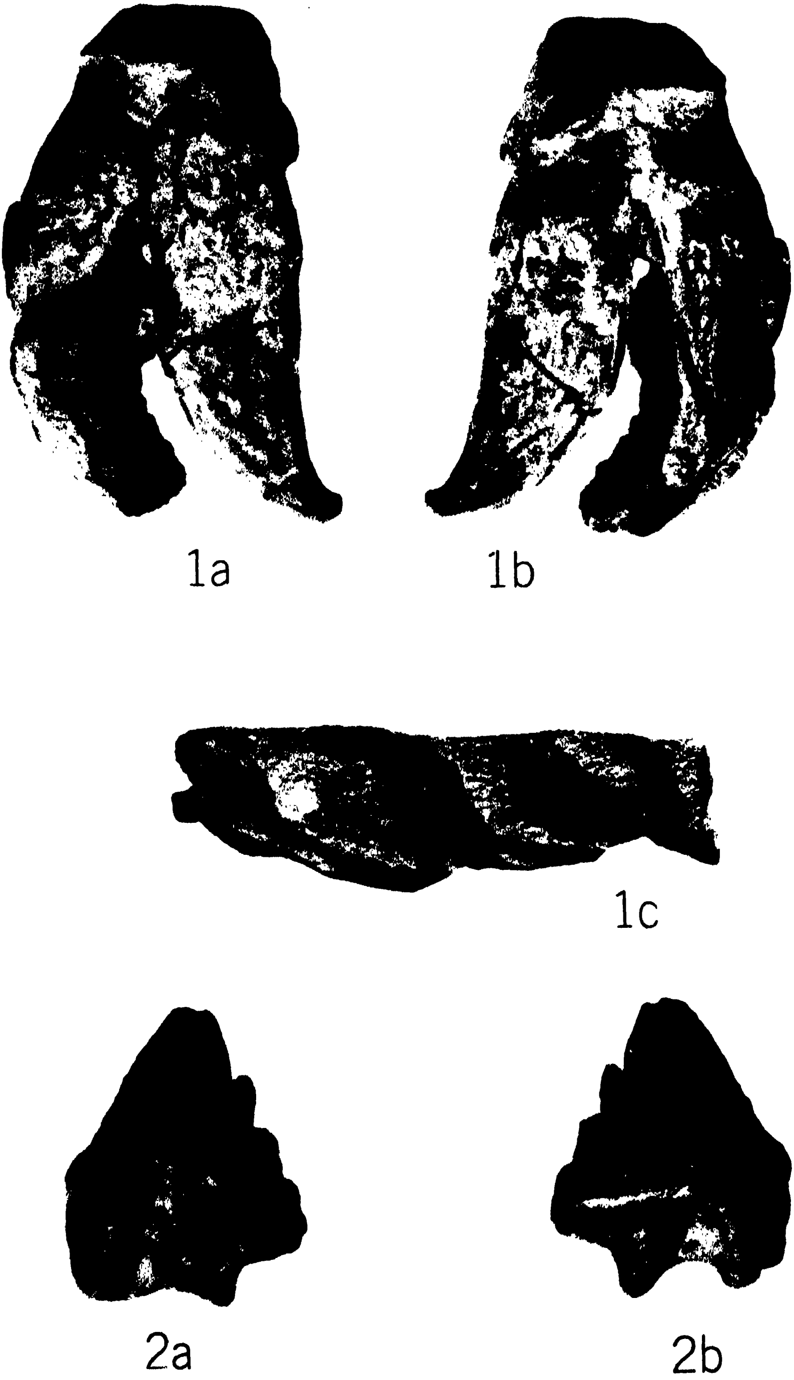
EPIPHYSES FROM VERTEBRAE OF SQUALODON CALVERTENSIS.

FOR EXPLANATION OF PLATE SEE PAGE 69.



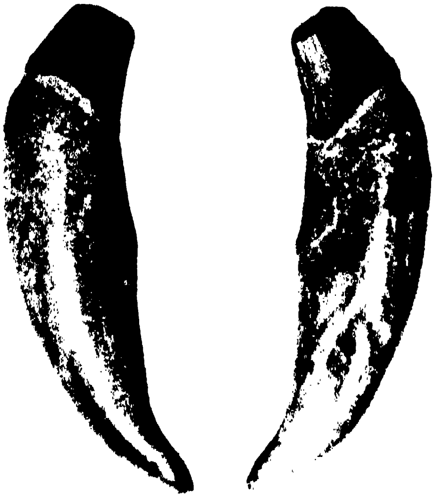
RIBS OF SQUALODON CALVERTENSIS.

FOR EXPLANATION OF PLATE SEE PAGE 69.

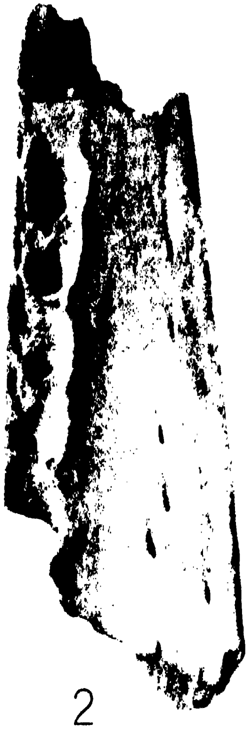


MOLARS AND JAW FRAGMENT OF UNDETERMINED SQUALODONT.

FOR EXPLANATION OF PLATE SEE PAGE 69.



1a 1b



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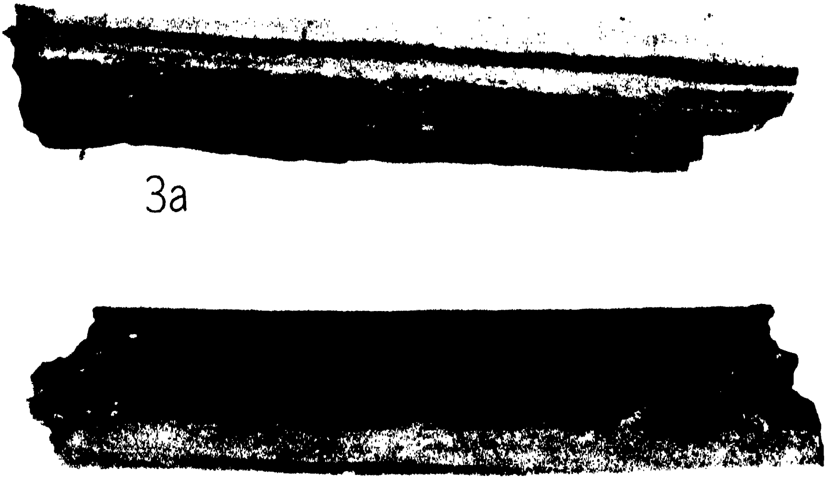

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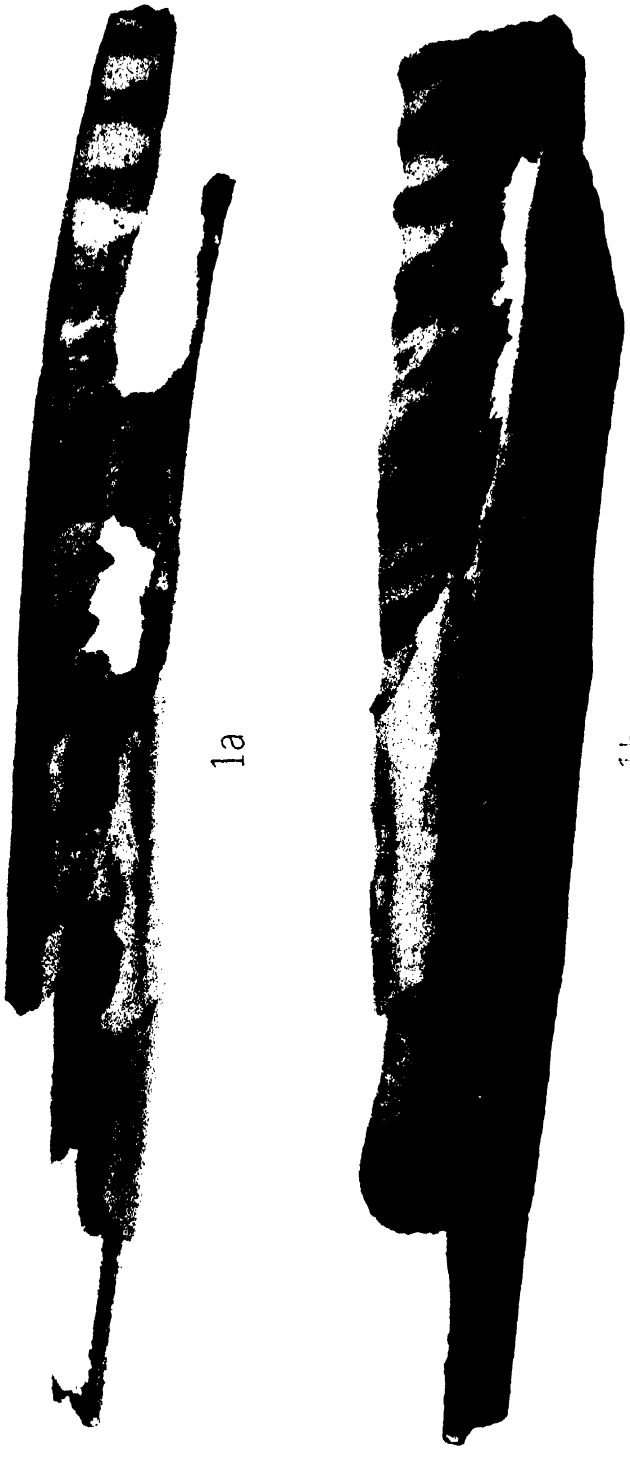
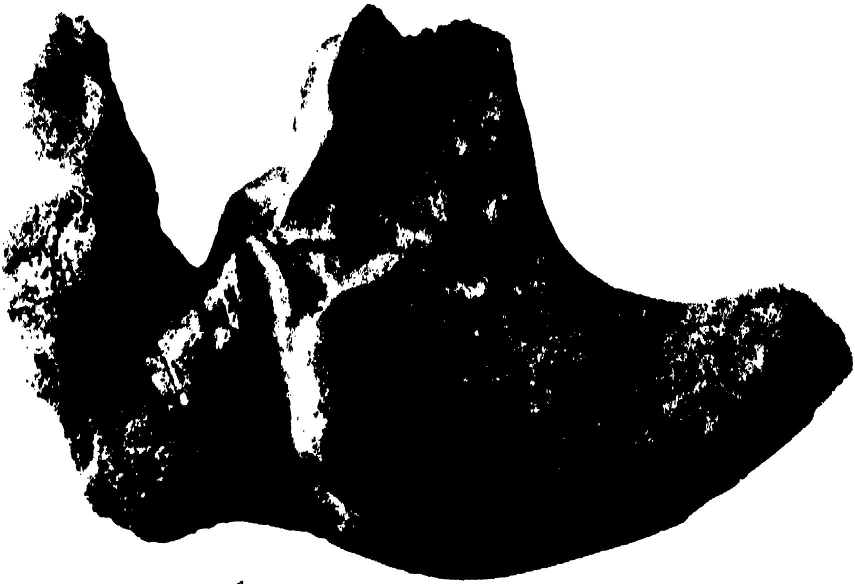
PREMOLAR TOOTH AND MAXILLARY FRAGMENTS OF UNDETERMINED SQUALODONT.

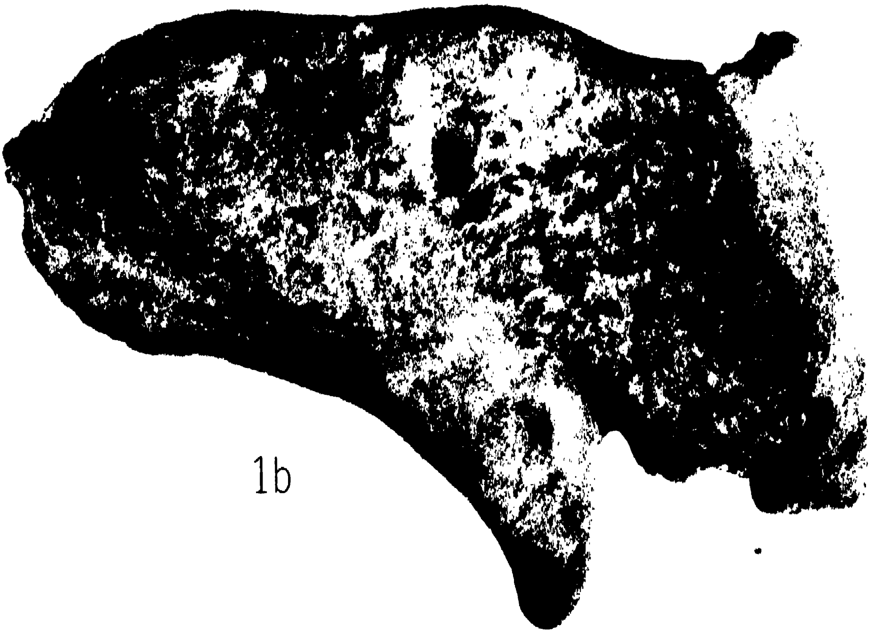


FRAGMENT OF LEFT MANDIBLE OF UNDETERMINED SQUALODONT.

FOR EXPLANATION OF PLATE SEE PAGE 63



1a



1b

ZYGOMA AND EXOCCIPITAL OF UNDETERMINED SQUALODONT.

FOR EXPLANATION OF PLATE SEE PAGE 60.

THE SCALE INSECTS OF THE SUBFAMILIES MONOPHLEBINAE AND MARGARODINAE TREATED BY MASKELL.

By Harold Morrison and Emily Morrison,
Of the Bureau of Entomology, United States Department of Agriculture.

INTRODUCTION.

The following paper is, in a sense, a continuation of the work begun through the publication of a previous article in these Proceedings[1] by the same authors, and the explanation of the circumstances which permitted the performance of that work, as given in the earlier paper, applies with equal aptitude to that which follows.

The species of the two subfamilies treated herewith, together with those of one other subfamily, the Ortheziinae, appear to be fairly definitely set off from the other members of the family Coccidae through the possession of abdominal spiracles in all stages and compound eyes in the adult male, but since Maskell described no new species of Ortheziinae, and since his collection apparently contains no improperly identified material belonging to this subfamily, no further consideration has been given in this paper to the species of Ortheziinae in his collection. Three species in this group, *Monophlebulus fuscus* (Maskell), *Ultracoelostoma assimile* (Maskell), and *Coelostomidia zealandica* (Maskell), have already been redescribed in detail and discussed in the earlier paper, and are in consequence only briefly referred to in the following pages.

In those genera where a study of the included Maskell species has involved a consideration of most or all of the other congeneric species advantage has been taken of the opportunity to present the results of such extended study, and to describe certain apparently new species discovered in the course of the work.

The text figures showing the structural characteristics of the various species have been prepared by the junior author.

Subfamily MONOPHLEBINAE.

Genus MONOPHLEBUS Burmeister.

MONOPHLEBUS TAMARINDUS Green.

References.—*Monophlebus*, sp. Maskell, Trans. New Zealand Inst., vol. 25, for 1892 (1893) p. 245.—*Monophlebus tamarindus* Green, Mem. Dept. Agr. India, Ent. Ser., vol. 2, No. 2, Apr., 1908, p. 17.

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[1] Proc. U. S. Nat. Mus., vol. 60, art. 12, no. 2407, 1922, pp. 1-120, figs. 1-37, pls. 1-6.

A careful comparison of the two specimens listed by Maskell under the above heading with a typical example of *M. tamarindus* Green indicates that Maskell's specimens are identical with the species described by Green, although little more than half as large, and with the derm still membranous and the areolations not yet visible. No attempt has been made to determine definitely whether or not the species is properly placed in the genus *Monophlebus.*

Genus DROSICHA Walker.

There can, the writers believe, be no question that the species definitely discussed below under the heading *Drosicha maskelli* (Cockerell), together with others from Peking, China, and elsewhere, are entirely typical of Walker's genus *Drosicha,* as his genotype specimens came from North China, and certain features of his all too-brief description coincide exactly with characters found in the specimens examined.

DROSICHA MASKELLI (Cockerell).

Reference.—Fernald Cat. Cocc. World, 1903, p. 19.

This species is represented in the Maskell collection by a number of slides, two of "adult female, 1896," one of "larva, 1896," one of "male pupa, 1896," one of "wing of male, 1896," one of "halterer of male, 1896," one of "eyes of male, 1896"; and by two adult females and one adult male mounted on black cardboard rectangles and bearing Maskell's No. 515.

Adult female.—Dried specimens much wrinkled, maximum length 6 mm., flat and rather thin dorsoventrally, but the body twisted; ground color dark brown, overlaid by a thin whitish pubescence, this more dense at the margin and dorsally; anterior notch plainly visible; derm clearing almost completely on treating with potassium hydroxide, but the insect retaining a light brown color due to the presence of numerous crowded dorsal spines; maximum length of mounted specimens 9 mm., maximum width 5 mm.; elongate oval, nearly elliptical, ends uniformly and equally rounded; antennae remaining dark brown, elongate, tapering somewhat, 8-segmented, the terminal longest; legs stout, fairly large, the under side of tibia and tarsus with two longitudinal rows of setae, these stout at base, very slender for most of their length; beak rather short and stout, with a narrow basal collar, and the large terminal section with an indistinct joint, the beak therefore possibly to be considered as 3-segmented; with two pairs of large thoracic and seven pairs of much smaller abdominal spiracles, the first with a few pores clustered at the opening, the last small, short, somewhat tapering tubes; derm pores small, scattered, but fairly numerous, multilocular disk type, mostly circular to somewhat oval, with oval center and six loculi, rarely with triangular center and eight loculi, or smaller and with four loculi; derm densely clothed dorsally and ventrally with slender "spines," stout at base, but tapering to delicate tips, these considerably more abundant than the pores, about 82μ long in the middle region of the body, the dorsal heavier and stouter than the ventral and 96μ at the margin; with an occasional seta, larger than the spines, scattered over the body, these more numerous, much longer and aggregated to form segmental clusters of relatively very large and long setae along the body margin; anal tube short, the opening with a chitinized rim with the posterior half more or less triangular; no ventral cicatrices located.

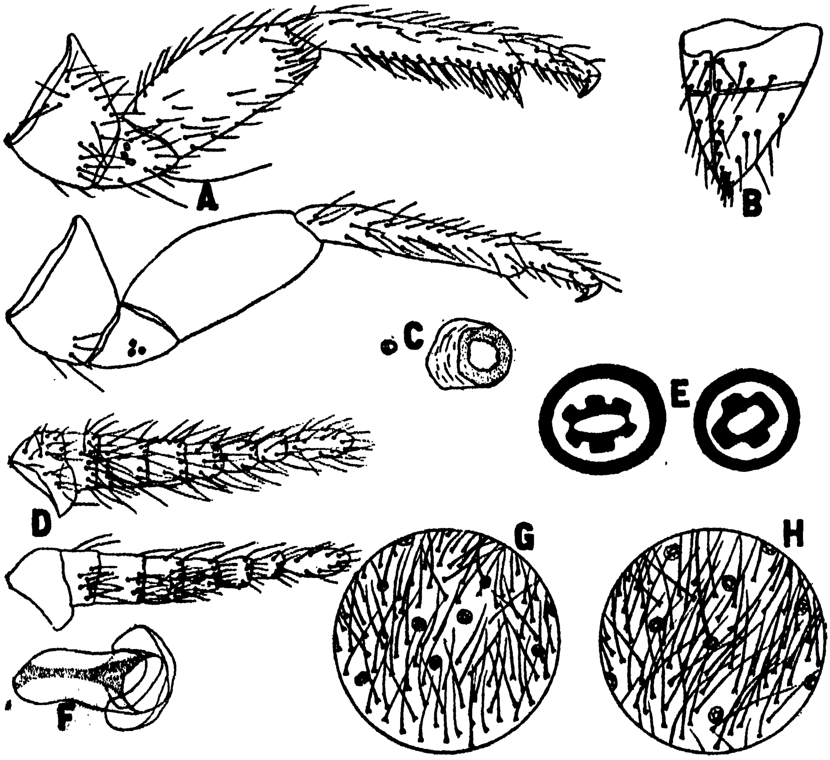

FIG. 1.—DROSICHA MASKELLI (COCKERELL). ADULT FEMALE. A, MIDDLE LEG, OPPOSITE SURFACES (1896 SLIDE), ×26.5; B, BEAK, ×57.5; C, ABDOMINAL SPIRACLE, ×57.5 AND ×335; D, ANTENNA, OPPOSITE SURFACES (1896 SLIDE), ×26.5; E, DERM PORES, ×1,500; F, THORACIC SPIRACLE, ×57.5; G, VENTRAL DERM, ×220; H, DORSAL DERM, ×220.

Larva.—Stout, oval, length 1 mm., width .65 mm.; antennae 5-segmented, the measurements in microns as follows: I, 68; II, 57–64; III, 118; IV, 36; V, 150–157; legs fairly long and stout for this stage, the measurements of middle leg in microns as follows: femur, 200, tibia, 214; tarsus, 168; claw, 39; claws with two hair-like digitules about as long as claw and two more or less distinct denticles near apex within; beak relatively elongate, 3-segmented and with a number of large and long setae at apex, length 161μ; width at base 100μ; spiracles not observed; derm pores of one sort only, small circular to oval disk pores with oval centers and six loculi, these probably in definite arrangement, never clustered; derm setae and "spines" much more numerous than pores particularly on dorsum, these similar in size and shape except at body margin, those on dorsum averaging about 43μ long, only the base showing the difference; margin of body with a series of relatively very long, prominent setae, each with a high basal collar, those along abdomen and on thorax not conspicuously shorter than the terminal setae as in some other species of the genus, the length of same in microns as follows: apical pair 518, second and third pairs (from apex) about 464; remaining abdominal pairs progressively shorter, prothoracic, 240; anal tube simple, without the double pore collar of many genera at its inner end, with a discontinuous circle of disk pores around its mouth; with a single, relatively large ventral cicatrix.

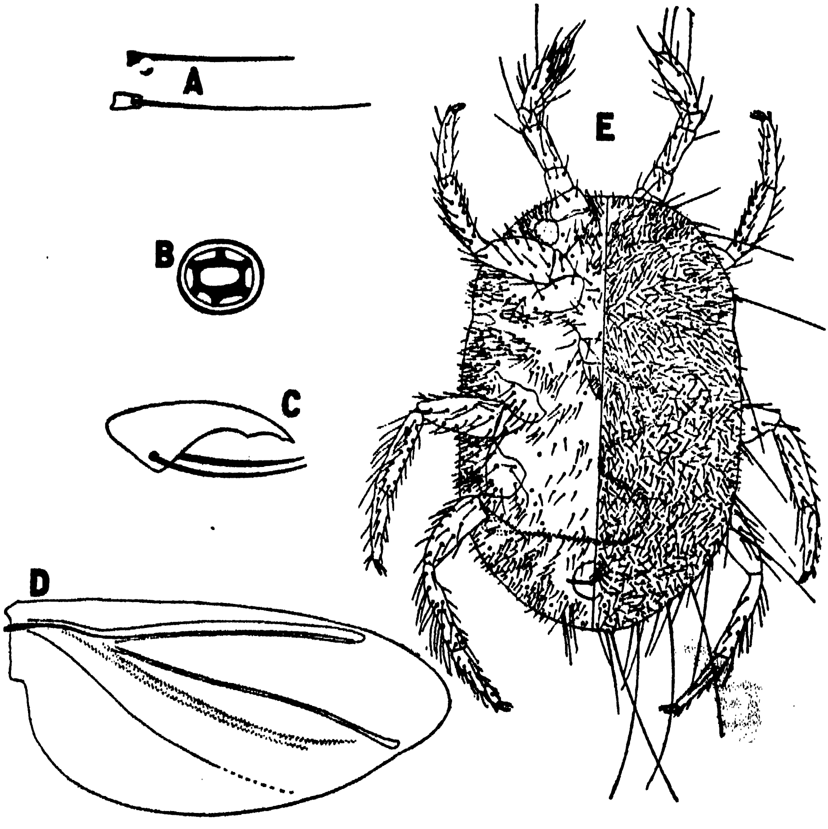

Fig. 2.—Drosicha maskelli (Cockerell). A, larva, dorsal spine and seta, ×500; B, larva, dorsal pore, ×1,500; C, larva, claw, ×640; D, adult male, wing, ×12; E, larva, dorsal and ventral, ×57.5.

Cotype.—Cat. No. 25266, U.S.N.M.

Aside from his identification of this species as *Monophlebus burmeisteri* Westwood, a determination which appears to be wholly without justification, Maskell has hopelessly confused it by mixing together, as one species, specimens from Yokohama, Japan, on *Pinus*, species, and from Hongkong, China, on *Gardenia florida.*

The writers have been privileged to examine some very careful and detailed, but as yet unpublished, work[3] on the Japanese species of this genus, prepared by Prof. S. I. Kuwana, Director of the Imperial Plant Quarantine Station of Japan, and the results of this examination, and of a careful study of specimens of his species in comparison with Maskell's specimens, may be summarized as follows:

1. No definite and tangible characters to separate the adult females of the species involved have been isolated thus far, the nearest approach to such appearing in slight differences in the shape of the body and in the shape of the beak.

2. The larvae appear to possess fairly tangible characters by which they may be distinguished, these occurring chiefly in the actual and proportional sizes of the body and its appendages, including the beak and the long marginal and apical setae, and in the size and shape of the tarsal claw.

3. On the basis of the larva, Maskell's specimens are quite obviously different from the species at present known to occur on *Pinus* at Yokohama.

4. The adult females among Maskell's specimens can *apparently* be divided into two lots, one of a single specimen, somewhat larger and stouter than the other three (2 mounted) and with a noticeably stouter beak.

5. In view of the larval differences, and in the absence of any further evidence, the writers conclude that the single Maskell larva and the largest mounted adult female *probably* represent one species and this the species found in Hongkong. It is concluded further that the remaining three adult females in the Maskell collection are *probably* the same as the species now found on *Pinus* in Japan.

6. The situation is still further tangled by the fact that Maskell lists the specimens from Yokohama on *Pinus* before the specimens from Hongkong, and these would logically receive the specific name *maskelli* in any splitting of Maskell's species.

7. In the apparent absence of any positive differentiating characters in the adult female, and the presence of these in the larva, the writers propose the restriction of the specific name *maskelli* (Cockerell) to the single larva in the Maskell collection, and include with it doubtfully a single mounted adult female specimen. This will

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[3] Published August, 1922. Bull. Imp. Plant Quar. Sta. Japan, No. 1, 1922, pp. 11–58, 12 pls.

leave the specimens on *Pinus* from Japan as an undescribed species which will be described presently by Professor Kuwana.[3]

8. It has not been possible from a comparative study of the single unmounted male specimen and the mounted parts of another male in the Maskell collection to determine anything regarding the proper status of these male specimens.

9. The correctness of the tentative conclusions given above can be verified only by the examination of additional material, including larvae, from the localities and hosts in question.

Genus MONOPHLEBULBUS Cockerell.

Reference.—Morrison and Morrison, Proc. U. S. Nat. Mus., vol. 60, art. 12, 1922, p. 4.

This genus has already been described and discussed at such length as the condition of the specimens of the type species would permit. On undertaking a careful study of all the species of the genus *Monophlebus* that had been described by Maskell it became evident that *M. crawfordi* and its variety *pilosior* were closely related to and congeneric with *M. fuscus*, the genotype of *Monophlebulus*. An examination of the undetermined material of this group in the Coccid collections available in Washington produced two apparently new species of the genus *Monophlebulus*, and these have been described below. With more or less material of all the known species that seem to be entitled to inclusion in this genus available, their relationships and specific differences are dicussed at some length following the descriptions.

MONOPHLEBULUS CRAWFORDI (Maskell).

Plate 1, fig. 1.

References.—*Monophlebus crawfordi* Maskell, Koebele, U. S. Dept, Agr. Div. Ent. Bull. 21, 1891, p. 20, fig. 9.[4]—*Drosicha crawfordi* (Maskell), Fernald Cat. Cocc. World, 1903, p. 19.

The Maskell collection includes the following slide mounts of this species: One of "adult females, 1888," one of antenna and foot of female, 1891, and one of "larva, 1892," and besides a few unmounted specimens under No. 92, while a few specimens from the local collections have also been available for study. From the above it will be evident that only the 1888 slide and an unmounted male are from the type material of this species.

Adult female.—External appearance discussed in some detail by Maskell in his various descriptive notes on the species and therefore not considered here, nor are the antennae and legs, which appear to possess no specific nor even generic peculiarities; body, as mounted, elongate oval, slightly broader behind the middle; derm clearing only

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[3] Described as *Warajicoccus pinicola*. See p. 29 of reference cited in footnote 2.

[4] Reference omitted by Fernald Catalogue of Coccidae.

incompletely, remaining light yellow brown after treatment with potassium hydroxide; beak short and stout, obviously 2-segmented; with two pairs of thoracic and seven pairs of abdominal spiracles, the first rather stout triangular, with a cluster of disk pores at the opening, the last much smaller, cylindrical or somewhat vasiform, less chitinized, and with a collar, usually incomplete, of disk pores surmounting its external opening; derm pores of two distinct types, one elongate, tubular, but trilocular, and with three tiny loculi alternating with the larger ones at the external opening, the other multilocular disk, with the central portion usually trilocular, but somewhat vary-

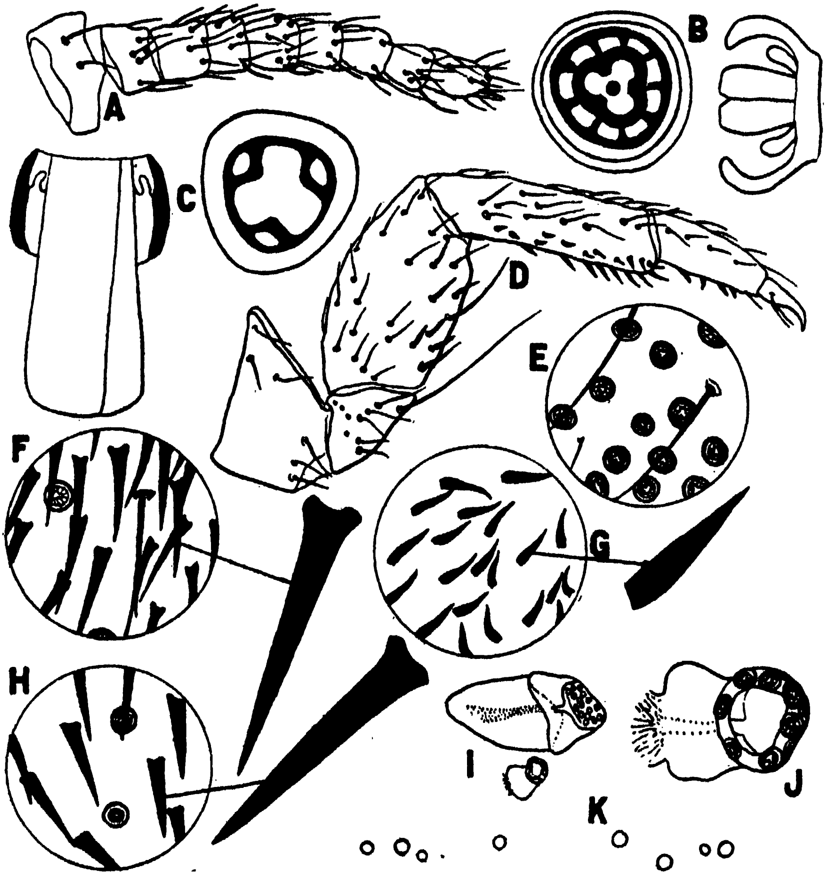

FIG. 3.—MONOPHLEBULUS CRAWFORDI (MASKELL). ADULT FEMALE. A, ANTENNA, ×57.5; B, DISK PORE, TWO VIEWS, ×1,500; C, TRILOCULAR TUBULAR PORE, TWO VIEWS, ×1,500; D, LEG, ×57.5; E, SECTION OF VENTRAL DERM JUST ANTERIOR TO VAGINAL OPENING, ×220; F, SECTION OF DERM DORSALLY BETWEEN POSTERIOR LEGS, ×220, WITH DETAIL OF SPINE; G, DERM NEAR MARGIN DORSALLY, ×220, WITH DETAIL OF SPECIALIZED SPINE, ×640; H, SECTION OF DERM VENTRALLY BETWEEN POSTERIOR LEGS, ×220, WITH DETAIL OF SPINE; I, THORACIC AND ABDOMINAL SPIRACLE, ×57.5; J, ABDOMINAL SPIRACLE, ×220; K, PORTION OF TRANSVERSE BAND OF ABDOMINAL CICATRICES, ×57.5.

ing, rarely oval, rarely quadrilocular, and with an outer band of smaller loculi, the appearance varying somewhat according to point focused upon, the dorsal pores of this type somewhat smaller than those occuring ventrally; the first type in indistinct clusters apparently confined to the body margin region in contrast to some other species, the second scattered very abundantly over the whole surface, but more numerous toward the margin than in the middle of the body, both dorsally and ventrally, the ventral disk pores in the region of the genital opening with oval and not trilocular centers; in addition to the preceding with numerous larger clear disk pores, unequal in size, arranged in transverse rows across the center, a single row to a segment on the thorax as well as the abdomen, these presenting much the same appearance as the ventral cicatrices of other genera except for the small size and much greater number; apparently without long trilocular pores in middle portion of body; derm near middle of body with small slender setae, each set in a conical collar, stouter, longer setae, also set in conical base, and long tapering, straight or very slightly curved, acutely pointed spines, each somewhat enlarged at base but without collar, these last somewhat stouter dorsally than ventrally, and gradually increasing in size and length toward the body margin on both surfaces, the setae increasing rapidly, some on the body margin relatively very long and slender; in addition along body margin with indefinite clusters, one to a segment, of smaller, more lightly chitinized, more swollen and usually distinctly curved spines without any sort of definite collar at base; most but not all of these on the abdominal segments; these spines probably corresponding to the stout, lanceolate spines of the derm of the genotype; spine measurements of this species, in microns, as follows: Mid-dorsal, shortest, 53; longest, 68; mid-ventral, shortest, 46, longest, 78; marginal, longest, 132; curved spine, average, 36; with a cylindrical anal tube having a heavy band of irregular wax pores at its inner end; ventral cicatrices discussed under derm pores; the actual density of the setae and pores apparently varying in this species as in others according to the degree of distension of the body as a result of the development of the ovaries.

Larva.—Essentially like that of *M. fuscus* in shape and other characteristics; antennae more elongate, 5-segmented, the third sometimes with faint indications of a division; legs long and slender, tip of claw with three indistinct denticles; digitules less than half length of the claw, with two pairs of large thoracic and seven pairs of relatively minute abdominal spiracles, all without pores; derm with some longitudinal rows of trilocular, rarely quadrilocular, disk pores dorsally and submarginally ventrally, and with a marginal series of 14 pairs of large trilocular tubular pores instead of 13 as in *fuscus*, with five longitudinal bands of lanceolate spines. one median, two marginal, two submarginal, these confused anteriorly, and with additional rows of slender setae both dorsally and ventrally; anal tube apparently much as in *fuscus*; with four pairs of small circular ventral cicatrices.

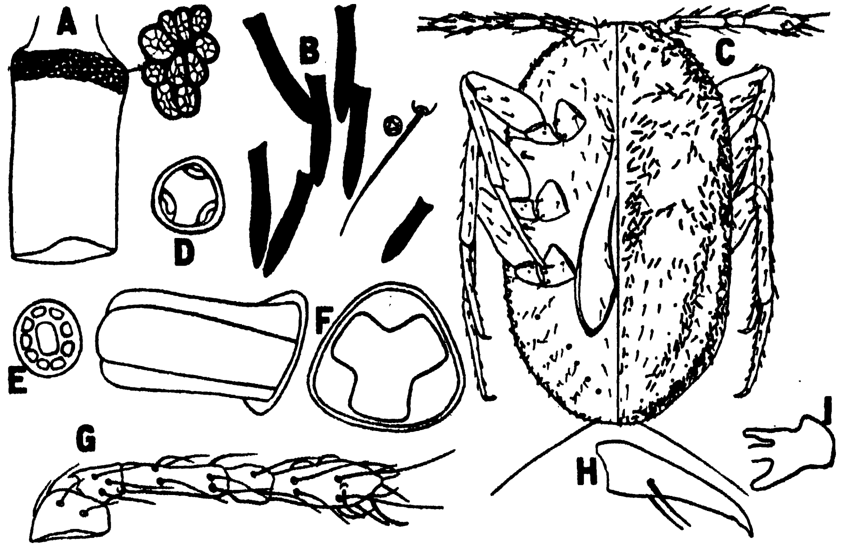

FIG. 4.—MONOPHLEBULUS CRAWFORDI (MASKELL). LARVA. A, ANAL TUBE, ×335, WITH DETAIL, ×1,000; B, PORTION OF DERM, ×500; C, DORSAL AND VENTRAL, ×57.5; D, PORE, 1,500; E, PORE FROM MOUTH OF ANAL TUBE, ×1,500; F, MARGINAL TUBLAR PORE, TWO VIEWS, ×1,500; G, ANTENNA, ×115; H, CLAW, ×640; I, ABDOMINAL SPIRACLE, ×1,500.

The adult female of this species has been redescribed primarily from the type slide in comparison with other specimens, some recieved by the Bureau of Entomology from Crawford in 1888, and probably from the same material which he sent to Maskell.

MONOPHLEBULUS PILOSIOR (Maskell).

Plate 1, fig. 2.

References.—*Monophlebus*, sp. Koebele, Bull. 21, U. S. Dept. Agri., Div. Ent., 1899, p. 20.—*Drosicha crawfordi*, var. *pilosior*, Fernald Cat. Cocc. World, 1903, p. 19.

This seems without question to be a distinct and valid species rather than a variety, the differences between it and *crawfordi* being particularly emphasized in the discussion following the specific description.

This species is represented in the Maskell collection under the name *crawfordi*, var. *pilosior*, by the following slides: One of "Adult female 1892," one of "antennae ♀, 1892," one of "larva 1892," and one of "larva 1893," and by a few specimens under No. 285.

The following description is based on Maskell's slides, together with one other, of an adult female, made from the type specimens.

Adult female.—External appearance, antennae and legs as described by Maskell and figured herewith; derm remaining somewhat chitinized, or clearing on treating with potassium hydroxide; spiracles exactly as in *crawfordi;* derm with the trilocular tubular pores in clusters, some well in from the margin, and with quadrilocular disk pores dorsally, these last rather widely separated as compared with *crawfordi,* ventrally with large multilocular disk pores with elgonate oval centers scattered over the surface, much more closely set in the genital region; in addition with circular center, deep, multilocular disk pores in segmental clusters at the margin ventrally; dermal setae slender, set in conical bases, small in mid-dorsal region, larger ventrally and much larger along the margin, scattered; derm spines longer and more slender than those of *crawfordi,* the tips hair-like, in this respect resembling those of *fuscus,* gradually increasing in length from center to margin of body, very abundant and closely crowded, this appearance depending to a considerable extent on the

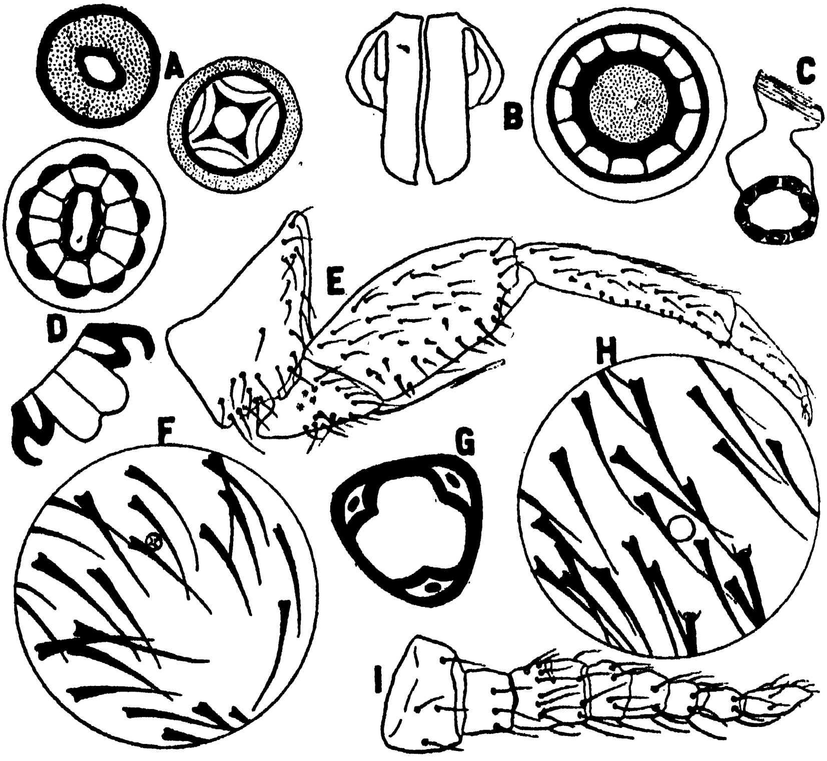

FIG. 5.—MONOPHLEBULUS PILOSIOR (MASKELL). ADULT FEMALE. A, DISK PORE, SHOWING APPEARANCE AT DIFFERENT FOCAL POINTS, ×1,500; B, DISK PORE, TWO VIEWS, ×1,500; C, ABDOMINAL SPIRACLE, ×220; D, DISK PORE, TWO VIEWS, ×1,500; E, POSTERIOR LEG, ×30; F, SECTION OF DORSAL DERM BETWEEN POSTERIOR LEGS, ×220; G, TRIOCULAR TUBULAR PORE, ×1,500; H, SECTION OF VENTRAL DERM BETWEEN POSTERIOR LEGS, ×220; I, ANTENNA, ×30.

distension of the derm, much more numerous than the pores over most of the body surface; spine measurements of this species in microns, as follows: Mid-dorsal, smallest 57, largest 82; mid-ventral, smallest 57, largest 86; marginal, largest, 178; without the lateral clusters of specialized spines of *crawfordi;* anal tube as in *crawfordi;* ventral cicatrices or clear pores in single irregular rows as in *crawfordi.*

Larva.—Differing in no visible particulars from that of *crawfordi.*

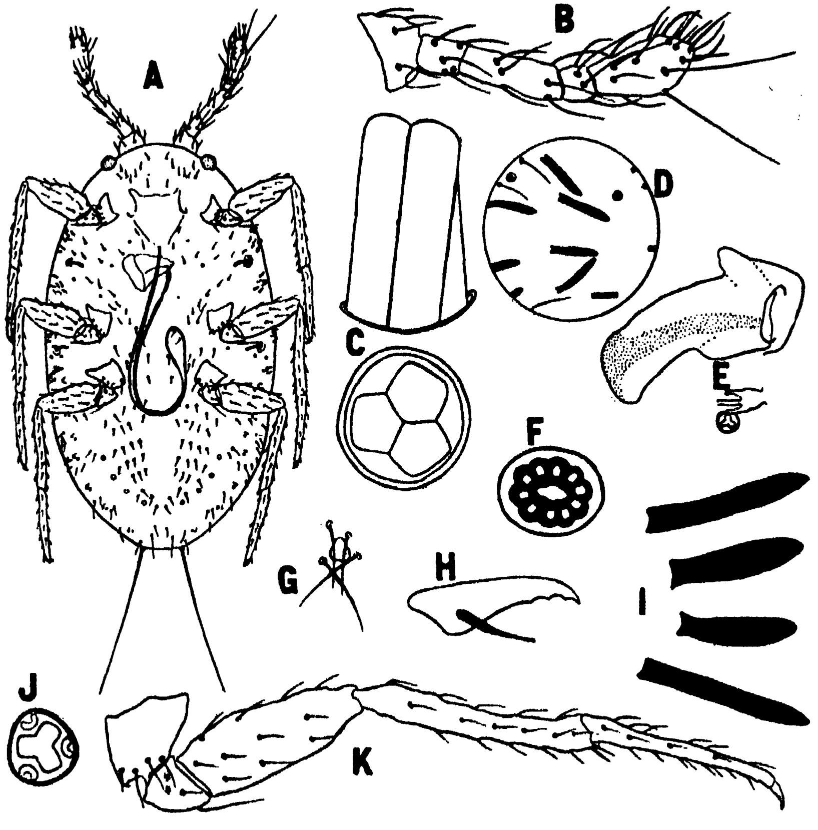

FIG. 6.—MONOPHLEBULUS PILOSIOR (MASKELL). LARVA. A, OUTLINE FROM BELOW, ×50; B, ANTENNA, ×115; C, TRILOCULAR TUBULAR PORE, TWO VIEWS, ×1,500; D, SECTION OF DERM DORSALLY BETWEEN POSTERIOR LEGS, ×220; E, THORACIC AND ABDOMINAL SPIRACLES, ×440; F, PORE, ×1,500; G, OPENING OF TRILOCULAR TUBULAR PORE, ×57.5; H, CLAW, ×640; I, DORSAL SPINES, ×640; J, PORE, ×1,500; K, LEG, ×115.

Cotype.— Cat. No. 25268, U.S.N.M.

In addition to the Maskell specimens, adult females from under bark of eucalyptus tree, Sydney, New South Wales, collected by George Compere under his No. 1049, have been examined. In these specimens, apparently due to the stretching of the derm, the crowded appearance of the dermal spines is much less conspicuous.

MONOPHLEBULUS COMPEREI, new species.

Plate 1, fig. 3.

Adult female.—Secreting a considerable quantity of white pulverulence, this in the dried specimens adhering closely to the body and forming a compact coating, leaving only the more prominent portions of the body exposed due to contact with other specimens; exposed portions of dried specimens an indeterminate blackish red; body usually shriveled and wrinkled transversely dorsally, elongate oval, similar to other species of genus in shape; length of dried

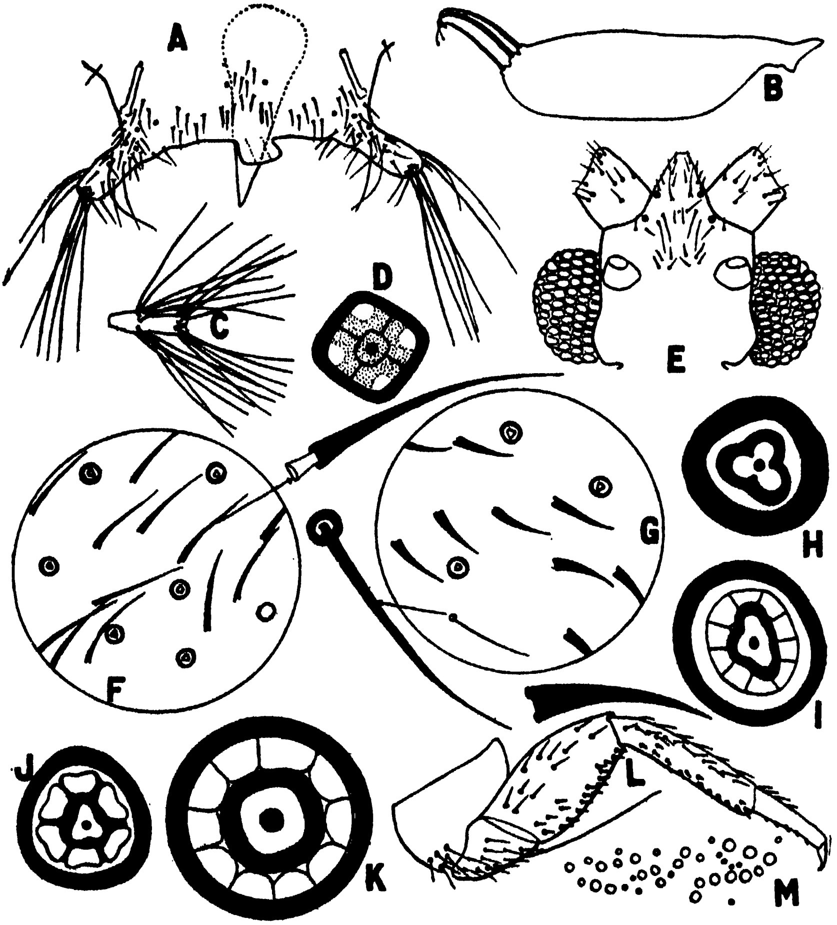

FIG. 7.—MONOPHLEBULUS COMPEREI, NEW SPECIES. A, ADULT MALE, APEX OF ABDOMEN, ×57.5; B, ADULT MALE, HALTERER, ×115; C, ADULT MALE, SINGLE ANTENNAL SEGMENT, ×57.5; D, ADULT MALE, DERM PORE, ×1,500; E, ADULT MALE, OUTLINE OF HEAD, ×57.5; F, ADULT FEMALE, SECTION OF VENTRAL DERM BETWEEN POSTERIOR LEGS, ×220, WITH DETAIL OF SPINE, ×640; G, ADULT FEMALE, SECTION OF DORSAL DERM BETWEEN POSTERIOR LEGS, ×220, WITH DETAIL OF SPINE AND SETA, ×640; H, ADULT FEMALE, DISK PORE, ×1,500; I, SAME, ANOTHER SORT, ×1,500; J, SAME, ANOTHER SORT, ×1,500; K, SAME, ANOTHER SORT, ×1,500; L, ADULT FEMALE, LEG, ×80; M, ADULT FEMALE, SECTION OF ONE ABDOMINAL BAND OF VENTRAL CICATRICES, ×57.5.

specimens ranging from 8 to 15 mm., width from 5 to 8 mm., dimensions of specimens as mounted on slide averaging slightly larger; derm remaining yellow brown or clearing almost completely on treating with potassium hydroxide; antennae 7-segmented, rather strongly tapering, the terminal longest, legs short, stout and heavy, the femur as well as the tibia and tarsus bearing a considerable number of heavy spines; beak short and stout, indistinctly 2-segmented; spiracles apparently not differing from those of other species of the genus; with clusters of scattered, large tubular, trilocular pores at the body margin, and similar submedian clusters one on each side of the middle line anterior to the anal ring, a pair to a segment; also with normally trilocular pores scattered rather uniformly over the surface; ventrally, with somewhat longer trilocular pores, with circular multilocular disk pores, these with elongate oval centers, and occurring chiefly in the genital opening region, and with circular disk pores with circular centers and distinct internal tube, similar to those of *pilosior*, in clusters over indeterminate areas; body thickly set with spines as in the other species, these more numerous than the pores over much of body, quite small dorsally, averaging 35–43μ long in the mid-dorsal region, some, in clusters, accompanying the dorsal groups of large tubular trilocular pores, considerably larger and longer; ventrally, opposite the small dorsal spines, averaging 57–68μ in length, offering a decided contrast to those of dorsum, those along margin the largest, the maximum length about 172μ; without the lanceolate spines of *fuscus* or the specialized spine clusters of *crawfordi*, in this respect, as in the character of most of the pore types, resembling *pilosior;* anal tube as in the other species of the genus; ventral cicatrices arranged in transverse rows as in the other species but much more numerous, and in relatively broad bands instead of irregular single rows.

Immature stages.—None available for examination.

Adult male.—Elongate, slender, length about 4 mm., maximum width (of flattened abdomen) about 1 mm.; head, antennae and legs dull pale brownish, thoracic lobes darker, with a blackish tinge, the wings slightly darker than the body, the anterior apical area darkest, the anal area nearly transparent; anterior apex of head triangular, antennae attached on basal portion of angles, posterior portion of head quadrate with the compound eyes strongly protruding and bulging; ocelli large, one placed just within each compound eye and nearly opposite its anterior margin; antennae more than 8-segmented (broken), the segments from III on elongate and slender, more or less distinctly constricted medially and each bearing a subbasal and a subapical whorl of long slender hairs; legs elongate, slender, bearing numerous long slender setae, these rather spine-like ventrally on tibia and tarsus; tarsus tapering, and slightly curved, without digitules, claw elongate, tapering, only slightly curved, without denticles, claw digitules slender setae, acute at apices, perhaps one-third the length of the claw, trochanters each usually with five pores above and below; thoracic spiracles large and conspicuous; abdomen elongate, parallel-sided, the margins of the anterior segments slightly bulging, those of the last three progressively more strongly protruding till the margins of the apical segment are produced into fingerlike fleshy protuberances some three or four times as long as wide; abdomen dorsally with transverse segmental rows of scattered quadrilocular gland pores and much more numerous slender setae, these last much longer at body margin, ventrally with setae only; abdomen probably with the same number of spiracles that are present in the female, but only the posterior ones plainly developed; sheath of penis elongate triangular, somewhat swollen at base and sharply pointed at apex, length 500μ, width at base 207μ.

Holotype and paratypes.—Cat. No. 25269, U.S.N.M.

This species has been described from six adult females and one male mounted on slides and from a number of unmounted females, all collected on *Eucalyptus* at Brisbane, Australia, by George Compere under his No. 1130.

MONOPHLEBULUS SUBTERRANEUS, new species.

Reference.—*Monophlebus*, sp. Koebele, U. S. Dept. Agri. Div. Ent. Bull. 21, 1890, p. 21.

Adult female.—Occurring on the roots of the host; elongate oval, strongly convex, broadest and somewhat swollen behind the middle, maximum length 22 mm., width about 10 mm., reddish brown, mottled in abdominal region with blackish (alcoholic specimen); color when received dead in Washington dull, dark brick red, according to notes made by Theodore Pergande; with only faint traces of secretionary covering, also according to Pergande; body as flattened on slide rather uniformly oval, maximum length 22 mm., maximum width 14 mm.; derm rather more heavily chitinized than in related species, remaining yellow brown after treatment with potassium hydroxide; antennae small compared to size of body, 9-segmented, stout and tapering, the terminal segment longest, legs a little larger, but small and fairly stout, the heavy spines on the tibia and tarsus distinctly longer and more slender than those of the other species in the genus; beak small, more elongate triangular than in the other species of *Monophlebulus*, very obscurely 2-segmented; thoracic and abdominal spiracles similar in number and appearance to those of related species, but with the pores accompanying each spiracle more numerous than with the other species; derm pores and setae each surrounded by a more or less distinct circular to oval clear area in the yellow brown derm; derm pores, in general, entirely comparable with those of the other species of the genus, with small multilocular disk pores, with usually triangular or quadrangular centers in the mid-dorsal region, scattered but not all abundant or crowded, with similar but somewhat larger pores in the mid-ventral region, laterally with a broad band of scattered, distinctly larger pores with circular to indefinitely pentagonal centers and relatively long internal tube, similar to those of *piloslor*, the area of larger pores delimited externally, at least on the posterior abdominal segments, by a fairly continuous band of small body spines; large trilocular tubular pores apparently lacking in this stage; derm spines small, the maximum length in the mid-dorsal region 39μ, in the mid-ventral region 57μ, dorsal spines averaging somewhat stouter and shorter than ventral; spines not conspicuously longer toward body margin, all spines relatively far less abundant and much more widely separated than in other species of the genus; body setae even more scattered than spines, a few near margin much longer; anal tube similar to that of other species in the genus; ventral cicatrices in irregular, transverse, single segmental rows in the abdominal region; in paired lateral clusters in thoracic region.

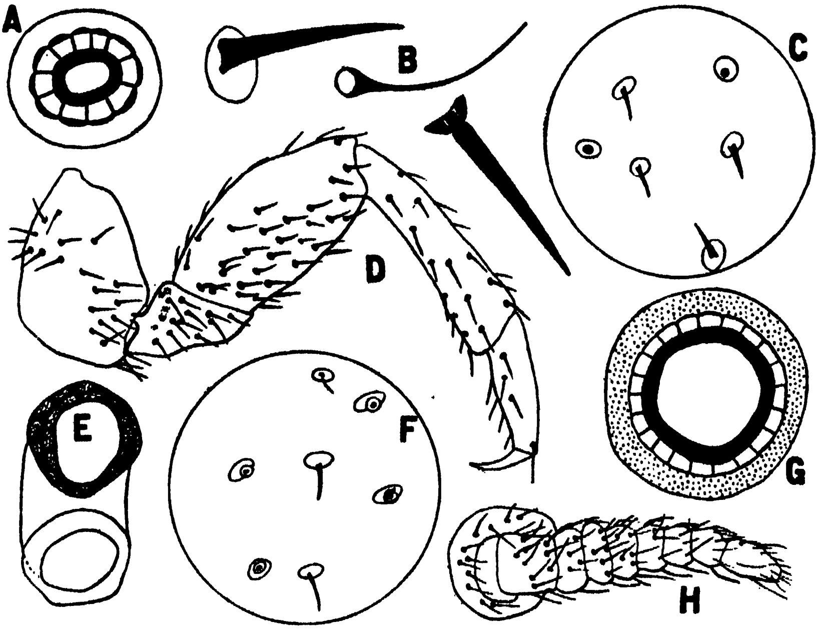

FIG. 8.—MONOPHLEBULUS SUBTERRANEUS, NEW SPECIES. A, ADULT FEMALE, DISK PORE, ×1,500; B, ADULT FEMALE, SETAE AND SPINES, ×640; C, ADULT FEMALE, SECTION OF DORSAL DERM JUST BEHIND POSTERIOR LEGS, ×165; D, ADULT FEMALE, LEG, ×57.5; E, PREADULT FEMALE, ANAL TUBE, ×165; F, ADULT FEMALE, SECTION OF VENTRAL DERM IMMEDIATELY BELOW THAT FIGURED AT C, ×165; G, ADULT FEMALE, DISK PORE FROM POSTERIOR PORTION OF ABDOMEN, ×1,500; H, ADULT FEMALE, ANTENNA, ×57.5.

Intermediate stage female.—Elongate oval, slightly broader behind, convex, maximum length 9.5 mm., width 4.5 mm. dull brown; segmentation distinct; antennae 8-segmented; legs somewhat stouter than those of adult, beak similar, spiracles similar, but with fewer pores; derm pores, spines and setae similar in appearance and arrangement to adult except that the marginal setae appear longer, that there is no marginal abdominal band of setae, that the large tubular pores appear to be lacking and that there are from one to three of the long tubular pores behind each abdominal spiracle, and a similar number at the margin of the anterior body segments; anal tube and ventral cicatrices much as in the adult.

No other stages available for examination.

Holotype and *paratypes.*—Cat. No. 25270, U.S.N.M.

This species has been described from two adult and one immature females mounted on slides, and from three unmounted alcoholic specimens collected on the roots of *Eucalyptus*, species, at Adelaide, South Australia, in 1888 by Mr.Albert Koebele, listed under "Div. Ent. No. 4390."

Certain pronounced differences, notably in the presence or absence of trilocular tubular and large circular pores, as described, are to be observed in the forms described here as adult and pre-adult females. However, the smaller size, the reduced number of antennal segments, the general resemblance in the relative number and arrangement of the pores and setae, the absence of any concentration of disk pores in the region of the genital opening, such as is found in the adults of all the species of the genus including this one, and finally the collecting of the specimens together, all argue in favor of the relationship indicated.

It is unfortunate that no larvae of this species have been available for comparison with those of other species of *Monophlebulus.* The adult female of this species diverges much more widely from the characteristic structural condition of the genus than does any of the other species, and without the the location of the trilocular tubular pores in the immature form its assignment to this genus would have been open to question. The main points of difference distinguishing this species from others of the genus are indicated in the key which follows.

The addition of four species, including two with known males, to this genus makes it necessary to alter to some extent the generic diagnosis given in a previous paper, and to add a diagnosis of the male stage to it. The following is therefore given as a revised characterization of this genus:

Monophlebine forms living on *Eucalyptus*, adult female elongate ovate, covered with more or less loose white secretion usually containing numerous glassy threads, probably always secreting a mass of white fluffy matter at oviposition; antennae 7–9-segmented, tapering, terminal longest; legs well developed, stout, the tarsus, tibia, and in some species, the femora, bearing numbers of stout spines; these less developed in one species; beak indistinctly 2-segmented, short and stout; with two pairs of thoracic and seven pairs of abdominal spiracles, the first much larger, the abdominal pairs cylindrical and with a cluster of pores around the opening of each; derm usually with large tubular trilocular ducts (responsible for the glassy threads of the secretion), with one to three different sorts of multilocular disk pores, these usually different dorsally and ventrally, and at least one sort relatively abundant, with scattered long slender setae set in conical bases, varying greatly in size but largest along body margin, usually with very numerous, closely crowded, long tapering, sharply pointed spines, these much less numerous in one species, usually largest along body margin, and with or without lanceolate or cylindrical specialized spines; with a large internal anal tube having a heavy band of irregular wax pores at its inner end; ventral cicatrices small, circular, very numerous, arranged in transverse rows across the abdominal segments anterior to the genital opening. Larva elongate oval, antennae 5-segmented, legs normal, slender, claw with one pronounced and one or two obscure denticles, claw digitules hair-like, number of spiracles as in adult, but these without pores and the contrast in size between thoracic and abdominal much more pronounced; derm with a marginal row of 13–14 pairs of large trilocular tubular pores, and with disk pores in longitudinal rows, with longitudinal bands of stout, cylindrical or lanceolate spines and with similar rows of slender setae; anal tube with a collar of wax pores and a ring of disk pores at opening; with four pairs of small circular ventral cicatrices. Male elongate, parallel-sided, antennae 10-segmented (Maskell), segments, except basal, constricted medially and bearing two whorls of hairs on each; apex of head triangular; compound eyes large, protruding, ocelli large; wings not unusual; abdomen elongate, parallel-sided, with spiracles; apical margin of segments more or less produced into fleshy finger-like appendages; penis sheath stout, tapering to an acute point.

On the basis of our present knowledge, the genus is exclusively Australian in its geographic distribution.

The principal distinguishing characters of the adult females of the included species are to be found in the character and proportional abundance of the derm pores and setae, structures whose differences are quite apparent on comparison but are difficult to express in words.

An attempt to indicate these is made in the following key to the species of the genus:

a^1. Derm with specialized, usually lanceolate or cylindrical spines; derm disk pores of two sorts only.

- b^1. Disk pores of two sorts, smaller trilocular, and large multilocular with oval to quadrilocular centers; specialized spines stout lanceolate, apparently scattered; antennae 7-segmented; size small (about 6 mm.). **fuscus** Maskell.[6]
- b^2. Disk pores mostly multilocular with large trilocular centers, smaller dorsally, larger ventrally, rarely, in genital region, with oval centers, trilocular tubular pores, occurring only at and near body margin; with clusters of small, slender, cylindrical to somewhat lanceolate specialized spines along body margin, especially in abdominal region; ventral cicatrices in single irregular rows; antennae 8–9-segmented; size larger, 8–14 mm. **crawfordi** (Maskell).

a^2. Specialized spines wanting, only the long slender conical sort present; ventrally and at margin with large tubular multilocular disk pores with circular centers, not found in preceding species, making three sorts of disk pores.

- c^1. Dorsal disk pores not appearing multilocular, but tri- or quadrilocular; derm spines crowded and abundant, tibia and tarsus with heavy spines; large tubular trilocular pores present; derm only slightly chitinized at maturity; size smaller, length not over 16 mm.; living on the trunks or branches of the host.
  - d^1. Dorsal disk pores normally with quadrilocular centers; derm spines large and closely crowded, distinctly more abundant than pores; dorsal and ventral spines in middle region of body averaging approximately the same length; ventral cicatrices in single irregular row; antennae 8–9-segmented .... **pilosior** (Maskell).
  - d^2. Dorsal disk pores normally with trilocular centers; derm spines not so numerous, not distinctly more numerous than pores; dorsal spines in middle region of body averaging much smaller than ventral in same region; the ratio approximately 6 to 10; ventral cicatrices more numerous, in transverse bands several pores wide; antennae 7-segmented. **comperei**, new species.
- c^2. Dorsal disk pores multilocular, with triangular or quadrangular centers; derm spines comparatively few, widely separated; tibia and tarsus with the spines longer and more slender; large trilocular tubular pores apparently wanting; derm relatively heavily chitinized at maturity; size large, 20–22 mm.; ventral body spines slightly longer than dorsal; abdominal cicatrices in single irregular rows; antennae 9-segmented; living on the roots of the host .... **subterraneus**, new species.

The larva of *M. fuscus* offers two definite characters which differentiate it from those of *crawfordi* and *pilosior*. These are the presence of thirteen instead of fourteen pairs of large, trilocular, tubular marginal pores, and the presence of a relatively decidedly shorter and stouter third antennal segment. No distinguishing characters have been observed between larvae of *crawfordi* and *pilosior* in the limited material available for examination.

Regarding Maskell's various comments on these species, particular mention may be made of his use of the presence or absence of a

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[6] Included after the study of only a small portion of one specimen.

"long white anal setae" as of value in separating *crawfordi* and *pilosior*. It seems evident that this refers to a hollow wax tube secreted for the purpose of conveying the liquid excrement into the open from the usual location of the insect beneath the back of the host, and equally evident from an examination of the anal tube of these insects that all of these species possess the structures necessary for the production of such a wax tube.

NODULICOCCUS, new genus.[6]

Monophlebine coccids, living on *Eucalyptus* in Australia; adult female oval, broader behind; antennae 9-segmented, tapering very strongly; legs normal; beak incompletely 2-segmented; with two thoracic and seven abdominal pairs of spiracles, the former with a cluster of pores at opening of each, the latter with a band of pores around opening of each; derm pores of two sorts, triangular, and multilocular disk with triangular or oval centers; derm with very stout, rounded conical spines dorsally and somewhat longer and more slender spines with rounded tips ventrally; derm setae of two sorts, stout, tapering but with bluntly rounded tips, not very long, and normal, slender, tapering, acute setae; anal tube short, with a band of irregular wax pores at inner end; ventral cicatrices intermediate in number, arranged in a semicircle. Larva elongate, outline irregular; antennae 5-segmented; legs normal; with a single pair of large apical setae, body dorsally with many small buttonlike tubercles, and laterally with clusters of fingerlike tubercles; dorsally also with small triangular disk pores and small setae set in stout bases.

The characters which cause this genus to diverge from any other known to the writers are found chiefly in the larva, in the curious development and modification of what are presumably to be considered as the dorsal cylindrical spines of the larvae of some other genera. The nature of the other larval characters and of many of those found in the adult seem to justify the inclusion of this genus with the group comprising *Monophlebulus*, *Walkeriana*, and others, although in no respect can *Nodulicoccus* be regarded as characteristic of the group, and it is probably the most widely divergent from the typical condition of any form that will be included in this group of genera. Why Maskell considered the type species *levis* as only a variety of his *Monophlebus crawfordi*, particularly after an examination of the larva of the species, is wholly incomprehensible.

NODULICOCCUS LEVIS (Maskell).

Plate 1, fig. 4.

Reference.—Drosicha crawfordi, var. *levis* (Maskell), Fernald Cat. Cocc. World, 1903, p. 19.

The Maskell collection includes two slides of this species, one of "adult female, 1892," the other of "larva, 1893," and two unmounted adults, one much larger than the other, bearing the Maskell No. 284. Only the two slides have been available for microscopic study.

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[6] New genera should be credited to the senior author only.

Adult female.—External appearances described by Maskell; apparently naked; shape as mounted on slide elongate ovate, distinctly broadened behind, length 10 mm., maximum width 6.5 mm., derm clearing completely on treating with potassium hydroxide; antennae 9-segmented, small, the basal segment greatly enlarged, the intermediate segments transverse, the apical elongate, almost lanceolate, the whole antenna tapering strongly from base to apex; legs very large and stout as compared with the antennae, with rows of slender spines on tarsus, tibia, and femur, claw entire, but the inner face often roughened, with two claw digitules of uncertain character (all broken); beak small, short, stout, incompletely 2-segmented; with two pairs of thoracic and seven pairs of abdominal spiracles similar in general to those of *Monophlebulus*, the abdominal located ventrally near margin, each with a collar of pores three wide around its opening; derm with pores of three sorts, small trilocular, scattered over most of the upper surface of the body, somewhat larger multilocular disk, with triangular, circular or short oval centers, found particularly dorsally around anal ring opening, and considerably larger multilocular disk with elongate oval centers, occurring over most of the ventral abdominal area, and most numerous around the genital opening; derm spines very short, stout and blunt dorsally, longer but still stout with rounded apices toward the margin ventrally, abundant but not closely crowded, most numerous in a poorly defined band running around the body ventrally just inside the abdominal spiracles; derm setae (as distinguished from spines by possession of basal collar) of two sorts, one short, stout, tapering but with bluntly rounded tips, the other, the normal slender, acutely pointed sort, usually much longer than the first, and found mostly around the anal opening and along the body margin; anal tube short, but of indeterminate length, with an external band of irregular wax pores, and on the dorsum immediately around the opening, a band of small setae, each pointing out, and, well outside of this, a single circle of very much larger, long, stiff setae; ventral cicatrices eleven in number, arranged in a semicircle about opposite the anal opening, the anterior four on each side circular to oval, the posterior three elongate, the size decreasing more or less continuously from the middle to apex of each horn.

Larva.—Elongate, somewhat wider about the middle, outline irregular, length 928μ, maximum width 400μ, anterior apex tapering somewhat; eyespots prominent, conical, antennae 5-segmented, the third and fifth longest, the third sometimes with a suggestion of a further diversion; legs long; terminal portions slender; claw with three more or less pronounced denticles on apical half; beak very short and stout, segmentation not discernible; spiracles not discernible; derm dorsally with a few trilocular disk pores in longitudinal

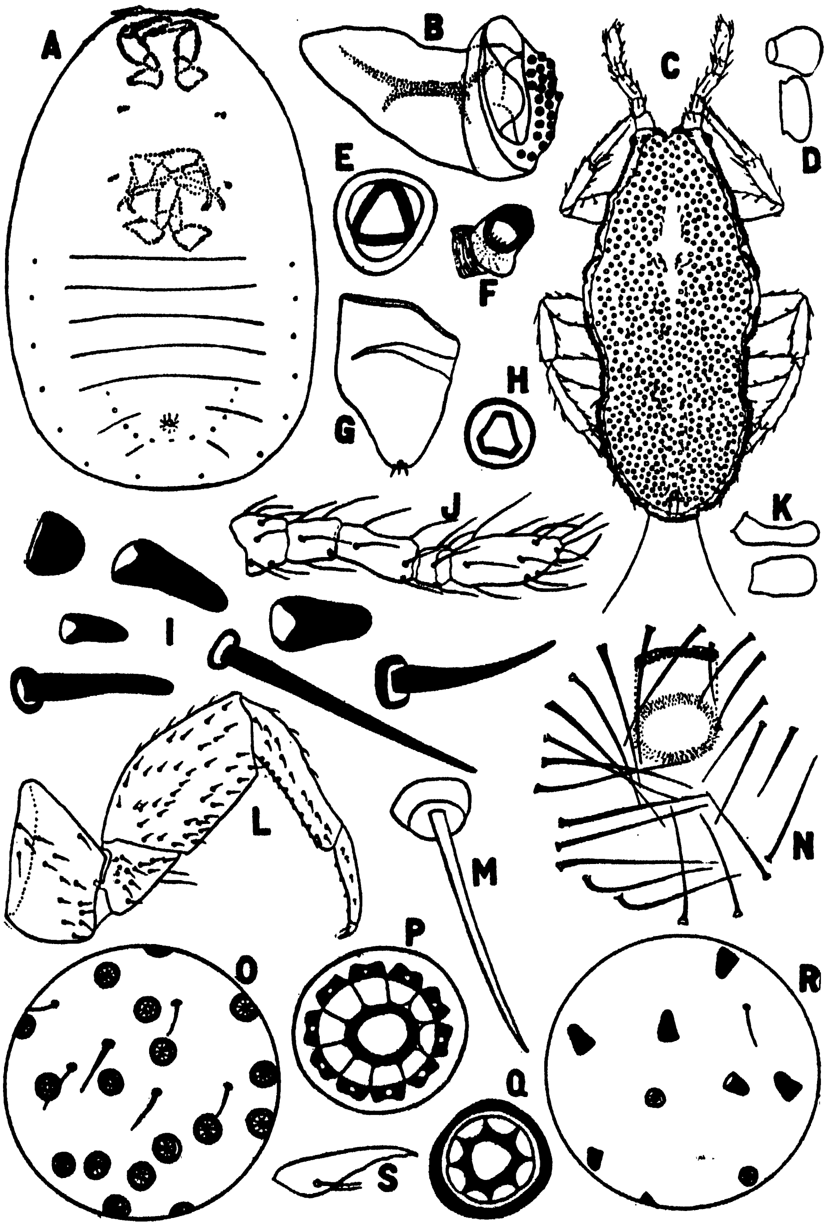

FIG. 9.—NODULICOCCUS LEVIS (MASKELL). A, ADULT FEMALE, OUTLINE FROM ABOVE, ×57.5; B, ADULT FEMALE, THORACIC SPIRACLE, ×115; C, LARVA, OUTLINE FROM ABOVE, ×57.5; D, LARVA, DORSAL "SPINES," ×640; E, ADULT FEMALE, DERM PORE, ×1,500; F, ADULT FEMALE, ABDOMINAL SPIRACLE, ×115; G, ADULT FEMALE, BEAK, ×57.5; H, LARVA, DISK PORE, ×1,500; I, ADULT FEMALE, DERM SPINES AND SETAE, ×640; J, LARVA, ANTENNA, ×165; K, LARVA, MARGINAL "SPINES," ×640; L, ADULT FEMALE, LEG, ×57.5; M, LARVA, SETA, ×1,500; N, ADULT FEMALE, ANAL RING AREA ×57.5; O, ADULT FEMALE, SECTION OF VENTRAL DERM ANTERIOR TO ANAL RING, ×220; P, ADULT FEMALE, DISK PORE, ×1,500; Q, ADULT FEMALE, DISK PORE, ×1,500; R, ADULT FEMALE, SECTION OF DORSAL DERM ANTERIOR TO ANAL RING, ×220; S, LARVA, CLAW, ×640.

rows, exact number and arrangement not discernible; other sorts of pores, if present, not recognizable; with a collar of pores around anal opening; derm dorsally with numerous, but not clustered, small tubercles, circular in outline and much flattened, with a constricted base as observed in section, these occurring nearly uniformly over the whole dorsal surface, except for a narrow marginal strip; laterally with dense clusters of longer, more nearly finger-like tubercles, these clusters almost continuous in the abdominal region, the ventral surface with a fringe of still longer tubercles, each constricted about the middle, most of ventral surface, as far as can be determined, without any such structures; dorsally and laterally, in addition to the knob-like protuberances, with a few longitudinal rows of slender setae; structure of anal tube not definitely determinable; ventral cicatrices not discernible.

AULOICERYA, new genus.[7]

Monophlebine coccids, related to *Icerya*, but the adult female naked, or nearly so, dorsally, not secreting an ovisac, but with the whole under side somewhat invaginated in a longitudinal groove, the margins of the body and this cavity bearing more or less dense white powdery wax secretion; body oval, derm more or less chitinized above, membranous in ventral cavity; antennae normal, 10–11-segmented, legs normal; body margin bearing scattered large setae and multilocular disk pores of two or three sorts, some of these most abundant along body margin, but not crowded into a dense poriferous band as in *Icerya*; with the usual thoracic spiracles, and with three pairs of posterior abdominal spiracles; anal tube simple, ventral cicatrices present, probably three in number. Larva, in general, similar to that of *Icerya*, but with the dorsal setae strongly developed and much more conspicuous than in the other genus; antennae 6-segmented, the terminal slightly enlarged; legs normal, slender, claw with denticle at apex and with digitules extending slightly beyond apex of claw and faintly knobbed: body with two or three pairs of long apical setae, at least one of these fully as long as body; anal tube with collar of disk pores around opening.

The genus is distinguished chiefly by the characteristic appearance of the adult female and by the conspicuous enlargement of the dorsal setae of the larva.

Genotype.—*Paleococcus australis* (Maskell).

AULOICERYA AUSTRALIS (Maskell).

Plate 1, fig. 5.

References.—*Paleococcus australis* (Maskell), Fernald Cat. Cocc. World, 1903, p. 21.—*P. rosae australis* (Maskell), Sanders, U. S. Dept. Agri. Bur. Ent. Tech. Ser. 16, pt. 3, 1909, p. 34.

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[7] New genera should be credited to the senior author only.

This species is represented in the Maskell collection by five slides, one of "adult female, 1894," one of "antennae of female, 1893," one of "larva, 1894," one of "male larva, alate, 1896," and one of "adult male, 1896," and by some specimens bearing No. 389. No other specimens have been available for study.

Adult female.—External appearance of mature females as described by Maskell, the colored spots of secretion very indistinct in the dried museum specimens, uniform dark reddish brown, maximum length 6 mm., the abdominal region dorsally shriveled and with large transverse folds, concave beneath for the entire length of the body, with a considerable amount of compacted fluffy secretionary matter, this filling the ventral groove, overlapping the body margin somewhat and spreading out on the adjacent portions of the host; body very strongly convex, approaching an ovate globular form at maturity; derm clearing to a considerable degree on treating with potassium hydroxide, but retaining some light yellow brown color; antennae rather large and long, 10–11 segmented, these and the legs retaining their dark color; measurements in microns as follows: II, 103; III, 89; IV, 107; V, 86; VI, 114; VII, 78; VIII, 82; IX, 93; X, 200; legs fairly long, femur stout, the parts of a middle leg with the following lengths in microns: Femur, 357; tibia, 346; tarsus, 321; claw, 89; claw stout, claw digitules relatively small and slender, with two pairs of thoracic and three pairs of abdominal spiracles, the latter at the posterior end of the body, the first much the largest, all without pores; derm pores dorsally of one type only, multilocular disk, with linear, oval, or trilocular centers, and the number of loculi varying from six to ten, scattered rather uniformly over dorsum, much more numerous in a wide band along margin; ventrally, in the thin abdominal membrance, less heavily chitinized, with large transverse center and four small loculi arranged in pairs on each side of, and close to, the center; genital region closely crowded with circular to oval, lightly chitinized, multilocular disk pores with oval or triangular centers, and as many as twelve loculi; derm setae, so far as noted, of one type only, long and slender, scattered, varying greatly in size, and relatively very large along the body margin, these last all broken, so actual length not determinable, all, so far as examined, with a conical collar at the base; anal opening a short, simple tube without pores; ventral cicatrices not noted.

Larva.—Elongate egg-shaped, tapering posteriorly, length 875μ, width 494μ, antennae 6-segmented, all but the first slender, the last strongly clavate, of normal, Icerya-like form, the measurements of one in microns as follows: I, 50; II, 61; III, 71; IV, 46; V, 54; VI, 143; legs slender, measurements in microns of a middle leg, femur, 140; tibia, 211; tarsus, 164; claw, 39; claw with a tiny denticle

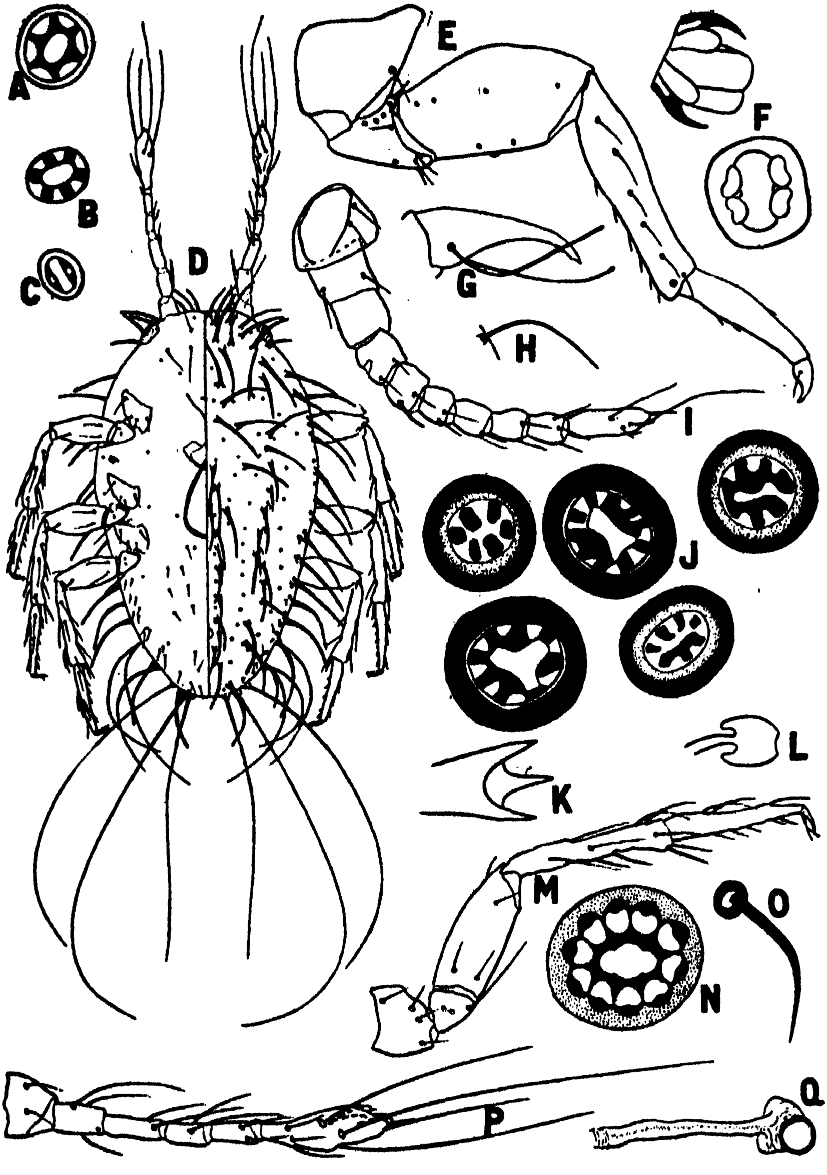

Fig. 10.—Auloicerya australis (Maskell). A, larva, disk pore from around anal ring, ×1,500; B, larva, dorsal disk pore, ×1,500; C, larva, ventral disk pore, ×1,500; D, larva, dorsal and ventral, ×57.5; E, adult female, leg, ×57.5; F, adult female, disk pore, two views, ×1,500; G, larva, claw, ×640; H, larva, seta, ×115; I, adult female, antenna, ×57.5; J, adult female, variations in more abundant disk pores, ×1,500; K, larva, tricuspidate apex of seta, ×1,500; L, larva, abdominal spiracle, ×1,500; M, larva, leg, ×115: N, adult female, ventral disk pore from region of vaginal opening, ×1,500; O, adult female, derm seta, ×500; P, larva, antenna, ×115; Q, adult female, abdominal spiracle, ×500.

near tip, and slender, delicate digitules with a slight apical knob, longer than claws; beak very broad, short triangular, length in microns 89, width 143; number and position of spiracles as in adult, difference in size even greater than in adult; dorsally with four longitudinal rows of tiny multilocular disk pores; ventrally with some longitudinal rows of small setae; dorsally with a few small setae in longitudinal rows, and with others, much larger and stouter and with stout, tricuspidate apices in three rows on each body half, one submedian, one marginal, the third intermediate, at least in the abdominal region, an average length for the median row 68–89μ, of the intermediate 75–100μ, of the marginal 100–150μ, all these normally more or less curved, the marginal strongly so; with three pairs of long primary apical setae, the inner, the shortest, about 642μ, the middle about 821μ, the outer about 607μ; anal tube normal, with a double band of pores at its inner end and a single continuous circle of disk pores around its mouth; no ventral cicatrices observed.

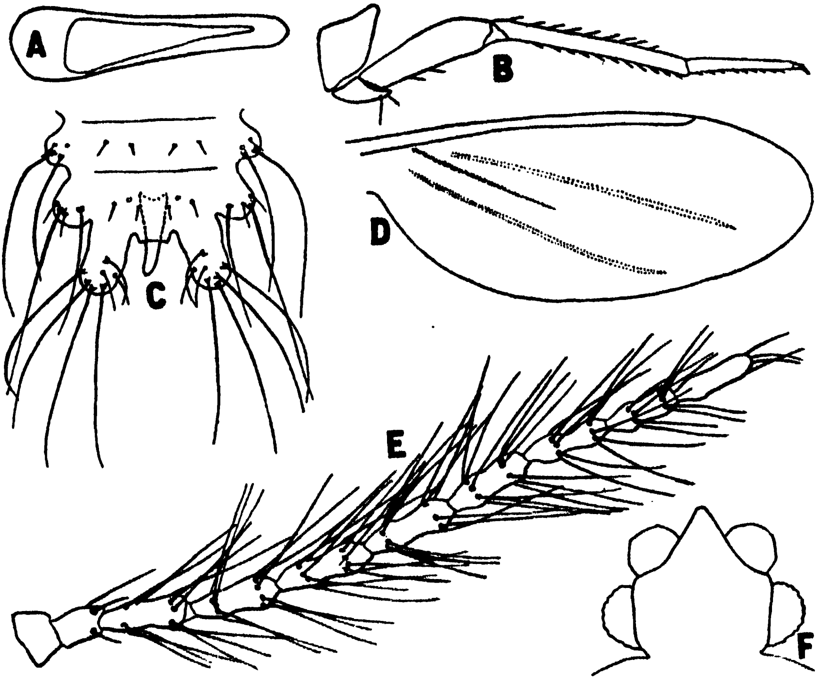

FIG. 11.—AULOICERYA AUSTRALIS (MASKELL). ADULT MALE. A, SHEATH OF PENIS, ×115; B, LEG, ×57.5; C, APEX OF ABDOMEN, ×57.5; D, WING, ×30; E, ANTENNA, ×57.5; F, OUTLINE OF HEAD, ×57.5.

Adult male.—No attempt has been made to redescribe the male, but some figures showing some of the structural characters are appended.

Cotype.—Cat. No. 25271, U.S.N.M.

AULOICERYA ACACIAE, new species.

Adult female.—Specimens originally preserved in a fluid which has evaporated, so nothing can be stated as to the normal secretionary covering of the insect; the shriveled insects strongly wrinkled, with the margin distinctly flattened, and a more or less pronounced hollow beneath; general color of body blackish brown, the thin margins very much lighter, pale reddish brown, translucent; legs and antennae black; body oval, evidently strongly convex in life; length flattened on slide about 8 mm., width about 6 mm.; derm retaining a faint yellowish tinge after treatment with potassium hydroxide; antennae normally 11-segmented, the basal cylindrical, the intermediate indistinctly moniliform, the apical elongate and longest, color blackish brown, even after treatment; legs moderately large, rather stout, darker than antennae, trochanters with two special pores on each face, with relatively few hairs, and the tibia and tarsus beneath with a few spines, each stout at base but tapering to an acute apex; beak short and stout, tapering, number of segments not determinable; with the usual two pairs of thoracic spiracles, the posterior somewhat larger and more expanded at inner and outer ends, and each with a

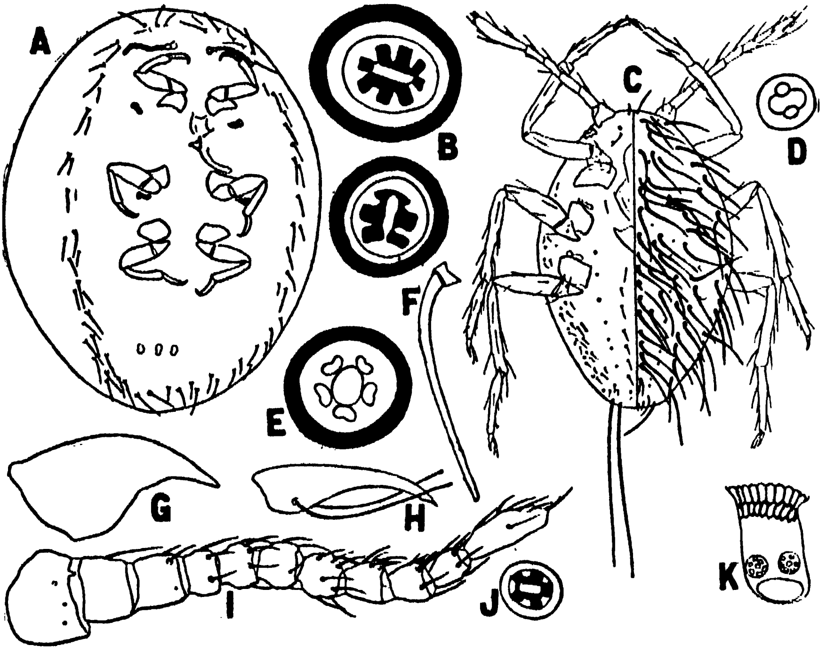

FIG. 12.—AULOICERYA ACACIAE, NEW SPECIES. A, ADULT FEMALE, OUTLINE FROM BELOW, ×7.5; B, ADULT FEMALE, DISK PORES, ×1,500; C, LARVA, DORSAL AND VENTRAL, ×57.5; D, LARVA, VENTRAL PORE, ×1,500; E, ADULT FEMALE, DISK PORE, ×1,500; F, LARVA, DORSAL SETA, ×220; G, ADULT FEMALE, CLAW, ×220; H, LARVA, CLAW, ×220; I, ADULT FEMALE, ANTENNA, ×57.5; J, LARVA, DISK PORE, ×1,500; K, LARVA, ANAL TUBE, ×500.

loose cluster of disk pores just beyond its opening; with three pairs of much smaller, simple, abdominal spiracles located at the posterior apex of the body; derm pores all of the multilocular disk type but varying in size and appearance as shown in figure, and including, in the region of the genital opening, the larger multilocular pores with thin wall, as figured for the genotype; body with a number of relatively very large, stout, blackish setae, with stout heavily chitinized bases, scattered along the margin all the way round and among these and over the rest of the body, but never clustered or crowded, much smaller, relatively inconspicuous, pale setae, varying considerably in size, and on the average a little less abundant than the pores; anal opening a simple, circular, lightly chitinized ring with a short, lightly chitinized, internal tube; ventral cicatrices three in number, located posteriorly, the median a little the largest, all three elongate with the ends rounded.

Larva.—Short oval, somewhat tapering behind, length 678μ, width 411μ; antennae 6-segmented, the sixth the longest and somewhat swollen; legs long and slender, the claws slightly curved, with a faint denticle near apex and with a pair of thread-like, faintly knobbed digitules slightly surpassing the tip of the claw; beak short conical, appearing indistinctly 2-segmented; number and position of spiracles as in adult; dorsal derm pores similar in appearance to most abundant adult sort, but smaller, ventral pores, as shown in figure, circular with elongate center with two loculi, one on either side of its middle; dorsal body setae relatively very large and stout, in six (abdomen) or eight (thorax) longitudinal rows, all with bluntly rounded apices, and all but those along margin strongly curved and twisted close to the base; with several much smaller setae around the anal opening; ventral setae small, slender, inconspicuous; anal tube with a circle of pores around the mouth and with the collar of wax pores usually present at the inner end in larvae of this group faintly indicated; ventral cicatrices not observed; apical setae in two pairs, broken, but probably about as long as the body.

Holotype and *paratypes.*—Cat. No. 25272, U.S.N.M.

This species has been described from one adult female and one larva mounted on slides, and from two or three unmounted females, collected on *Acacia hueglii*, Swan River, West Australia, by George Compere (No. 950).

In view of the lack of information regarding the normal habit characteristics of the adult female of this second species and certain structural divergences in the larvae, there is some question as to the correctness of the generic association indicated. With the limited material available for comparison, no definite key for separating the adults can be given; however, in *australis* the pores in the marginal band appear to be about twice as numerous for the same area as in *acaciae*, while the reverse of this condition appears to hold in regard to the large marginal setae, these being much more conspicuous and more numerous in *acaciae* than in *australis*. The larvae may be very readily differentiated by an examination of the large dorsal setae, these having slightly enlarged, usually tricuspidate apices in *australis* and bluntly rounded apices in *acaciae*, and by the presence of three pairs of long apical setae and some shorter, lateral slender setae in *australis* in contrast to the two apical pairs and the lack of lateral slender setae in *acaciae*.

Genus STEATOCOCCUS Ferris.

STEATOCOCCUS NUDATUS (Maskell).

Reference.—*Paleococcus nudatus* (Maskell), Fernald Cat. Cocc. World, 1903, p. 22.

This species is represented in Maskell's collection by two slides as follows: One of "adult female, 1895," and one of "larva, 1895." No unmounted specimens have been located, although according to Maskell's notebook there should be some present under No. 475. Additional specimens from the National Collection of Coccidae, collected by George Compere (No. 361), at Corawa, New South Wales, "on various species of grass" have been available for comparative study.

Adult female.—Maskell's description of the external appearance of of this insect sufficiently charateristic; abdominal cavity largely filled at maturity by a dermal sac, invaginated from a point on the center of the abdomen just posterior to the hind legs, in which the eggs are presumably laid, and from which the larvae emerge, the entrance to the sac indicated by a somewhat transverse oval opening, the posterior border of this forming a heavily chitinized rim, the anterior hardly distinguishable from the adjacent derm, all this overlooked by Maskell; specimens as mounted on slides as much as 6 mm. long by 5 mm. wide, egg-shaped, broadest behind the middle; derm clearing almost completely on treating with potassium hydroxide; antennae moderate in size, 10-segmented, not unusal; legs large and stout, the claw stout, the digitules slender; beak short and stout, indistinctly 2-segmented; with two pairs of large thoracic and three pairs of much smaller abdominal spiracles, the latter at the posterior end of the body, the thoracic much the larger, all simple; derm with small, circular to somewhat oval, disk pores scattered widely and rather uniformly over the surface both dorsally and ventrally, with circular, triangular or oval centers, the latter predominating, and about nine loculi, also some with fewer loculi, perhaps the same sort incompletely developed; dorsally in anal ring region and ventrally and internally in genital region with somewhat larger, less heavily chitinized circular pores, these quite crowded in the genital region, and finally with an irregular band of considerably larger, scattered, circular, tubular, open center pores, similar to those of *Icerya seychellarum* and *purchasi*, for example, each with about six to eight widely separated loculi; these also occurring between head and anal opening in about six clusters; derm setae, so far as noted, of one sort only, long, slender, tapering, all with a distinct basal collar,

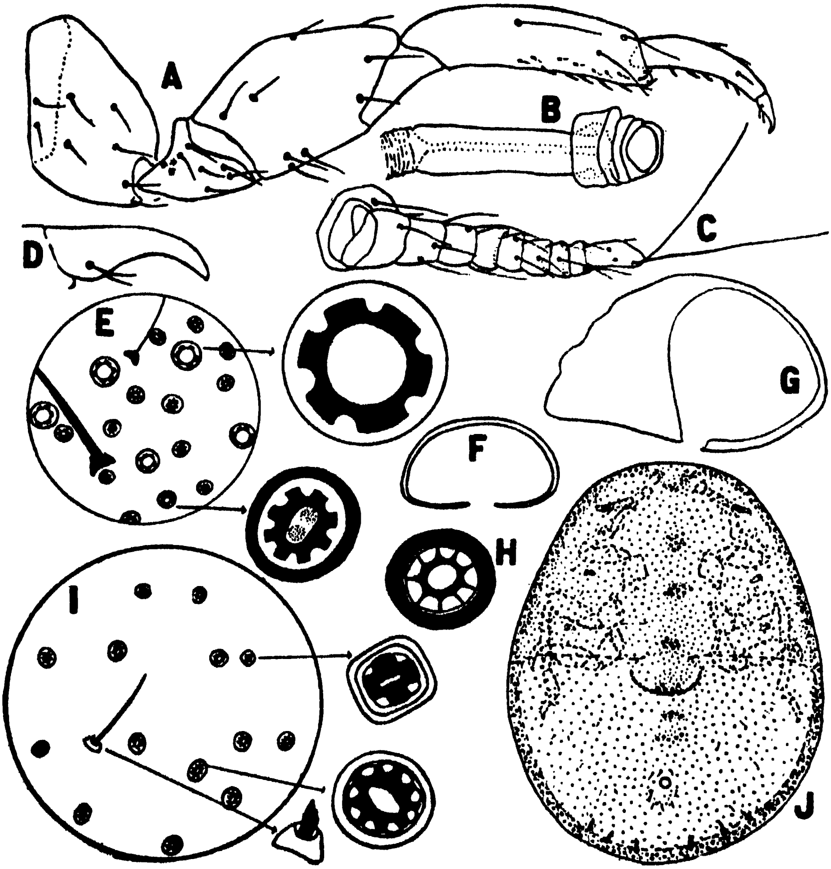

FIG. 13.—STEATOCOCCUS NUDATUS (MASKELL). ADULT FEMALE. A, LEG, ×57.5; B, ABDOMINAL SPIRACLE, ×440; C, ANTENNA, ×57.5; D, CLAW, ×165; E, SECTION OF DORSAL DERM ANTERIORLY AT MARGIN, ×220, WITH DETAILS OF PORES, ×1,500; F, CROSS SECTION THROUGH ABDOMEN (DIAGRAMMATIC); G, LONGITUDINAL VERTICAL SECTION THROUGH BODY, ×7.5; H, DISK PORE, ×1,500; I, SECTION OF DORSAL DERM, ×220, WITH DETAILS OF PORES AND SETA BASE, ×1,500; J, OUTLINE OF BODY FROM ABOVE, ×12.

these setae varying greatly in size and relatively very large along the body margin and in the anal ring region; anal opening a simple ring with a short, simple, somewhat chitinized tube; with a single, large, approximately circular, ventral cicatrix.

Larva.—Elongate ovid, broadest before the middle, length about 821μ, width about 465μ; antennae 6-segmented, the measurement in microns as follows: I, 57; II, 64; III, 54; IV, 54; V, 39; VI, 136; legs normal, slender, length of a middle one in microns, femur, 150; tibia, 200; tarsus, 150; claw, 43, claw with a single pronounced denticle near apex, digitules slender, delicate, longer than claws, with a slight knob at apex; beak short and stout; spiracles as in adult; dorsally with eight longitudinal rows of small, oval, multilocular disk

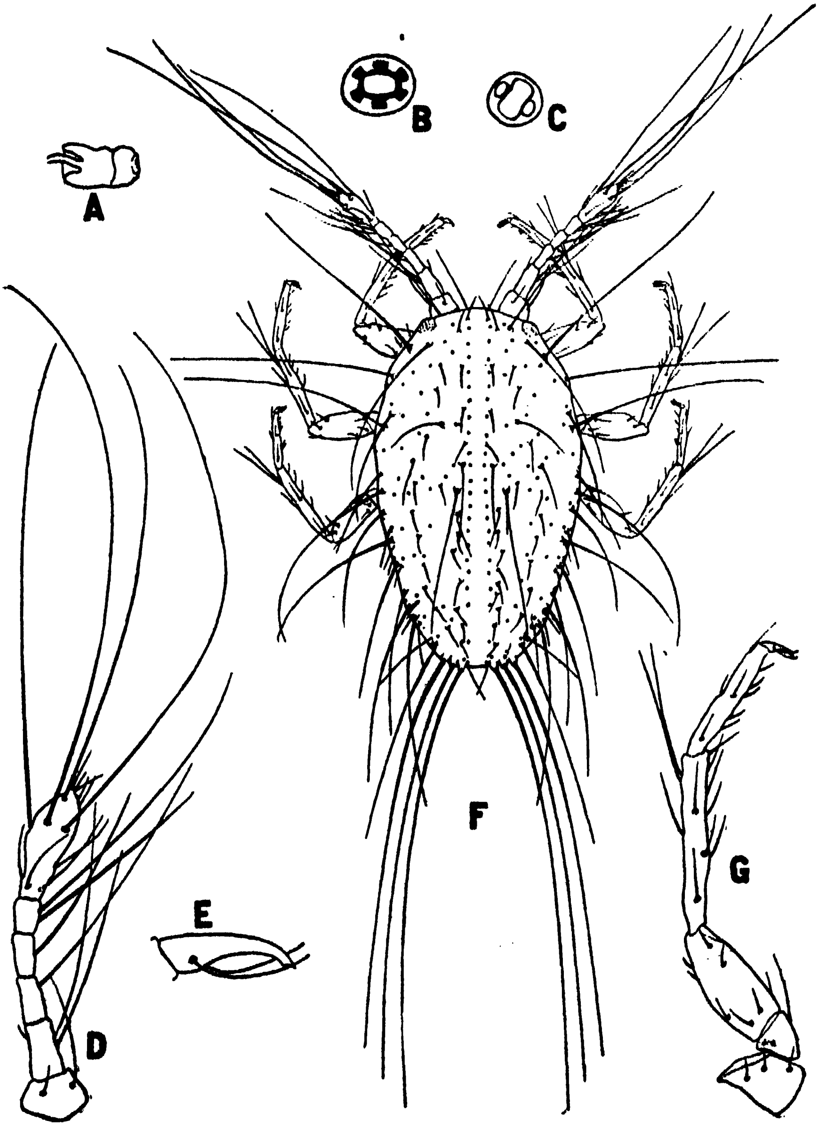

FIG. 14.—STEATOCOCCUS NUDATUS (MASKELL). LARVA. A, ABDOMINAL SPIRACLE, ×1,500; B, DORSAL DISK PORE, ×1,500; C, VENTRAL DISK PORE, ×1,500; D, ANTENNA, ×115; E, CLAW, ×440; F, OUTLINE, ×57.5; G, LEG, ×115.

pores, the inner submedian, the outer marginal, at least in the abdominal region; ventrally with a single submarginal row of circular bilocular pores with large and elongate centers, and finally with an interrupted circle of round pores with six loculi around the anal opening; derm setae all slender, all with basal collars, with three pairs of long, primary setae at the posterior apex of abdomen, these longer than the body, lateral abdominal setae much shorter, but still long and slender, with some long setae and some shorter and somewhat stouter ones in six longitudinal rows dorsally, the outer two marginal, this arrangement confused anteriorly; with rows of similar but much smaller setae ventrally; anal tube normal, with a double collar internally, and a discontinuous circle of disk pores at mouth; possibly with a single protruding ventral circatrix, this not certain.

Genus ICERYA Signoret.

ICERYA KOEBELEI Maskell.

Plate 2, fig. 1.

Reference.—Fernald Cat. Cocc. World, 1903, p. 24.

This species is at present represented in the Maskell collection by the following slides: One of "adult female, 1892," one of "2nd stage female, 1892," one of "larvae, 1892," one of larvae 1892" (3), and one of "wing, abdomen and antenna of male 1892." There is also a slide without name, but bearing the label "Icerya 283, from Koebele, Jan. 92, larva," which appears to be this species, as this number was assigned by Maskell to his unmounted specimens of the species, consisting of two unmounted adult females.

Maskell's description of this species appears to be unusually accurate, and the writers have therefore confined the redescriptive notes almost wholly to certain anatomical features of the insect which were not described by him.

Adult female.—As described, except that long, glassy threads may be noted projecting out of the body secretion, Maskell's statement "but observations of several specimens did not show any tubular spinnerets or glassy tubes," implying that these are wanting; length 2.5 mm., derm clearing completely on treating with potassium hydroxide, bearing numerous, long, conspicuously blackish, hair-like setae, these not plainly segregated in tufts as in *purchasi*; antennae of the usual form for the genus, 10-segmented; legs normal; with two pairs of thoracic and, so far as can be determined, two pairs of abdominal spiracles, these located at the posterior apex of the body and with the hinder pair larger; derm pores, as in *purchasi*, of two sorts the smaller circular to oval, with oval centers and six to eight loculi, these scattered abundantly over the body, the larger circular, short tubular, with an open circular center with a little point on one side, and about 8–10 loculi, these pores apparently confined to the body margin; ventral ovisac secreting pore band made up of pores of the first type and apparently without accessory setae anteriorly, laterally with an occasional small seta; derm setae, as already stated,

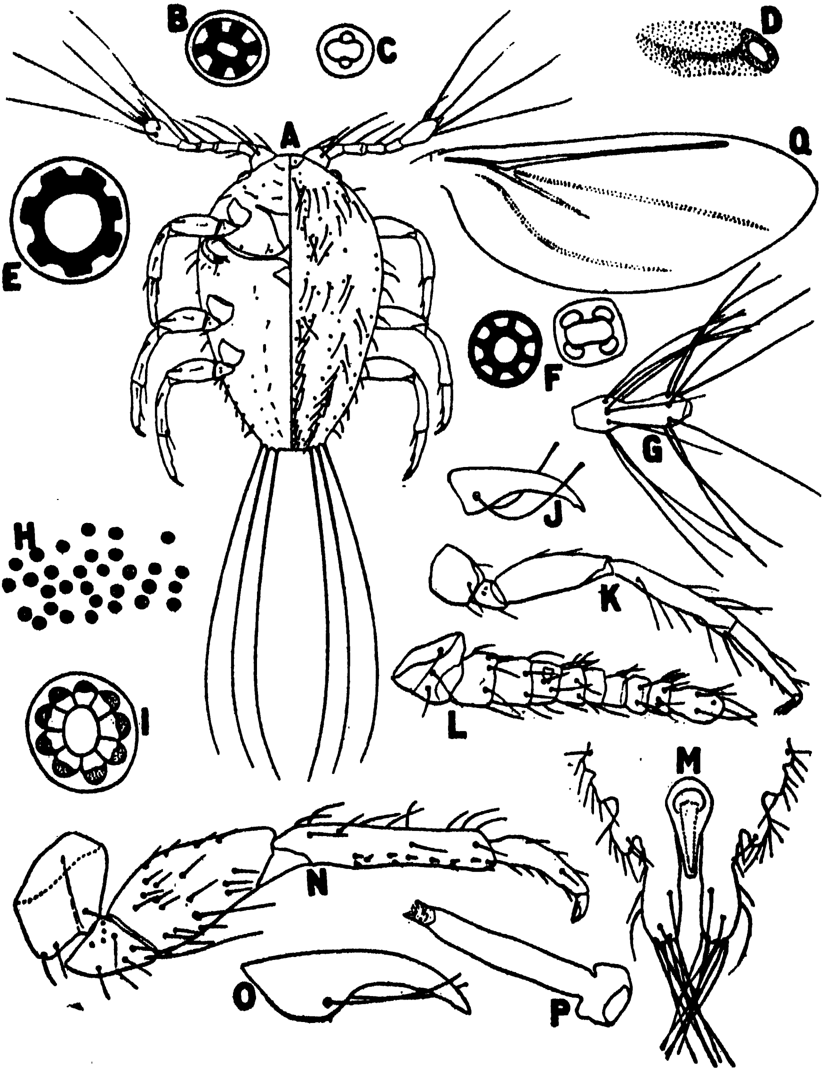

Fig. 15.—Icerya koebelei Maskell. A, larva, dorsal and ventral, ×57.5; B, larva, dorsal disk pore, ×1,500; C, larva, ventral disk pore, ×1,500; D, larva, thoracic spiracle, ×500; E, adult female, disk pore, ×1,500; F, adult female, disk pores, ×1,500; G, adult male, single antennal segment, ×57.5; H, adult female, portion of ventral pore band near posterior legs, ×220; I, adult female, disk pore from area around vaginal opening, ×1,500: J, larva, claw, ×220; K, larva, leg, ×115; L, adult female, antenna, ×150; M, adult male, apex of abdomen, ×57.5; N, adult female, anterior leg, ×150; O, adult female, claw, ×440; P, adult female, abdominal spiracle, ×440; Q, adult male, wing, ×17.5.

numerous, long, blackish and hair-like, but not aggregated into conspicuous marginal tufts; anal opening with a simple ring and a short, simple, internal tube; with three rather large ventral cicatrices, the median approximately circular, the two lateral elliptical.

Intermediate stage female—Essentially similar to adult; for details see Maskell's description.

Larva.—Length 0.625 mm., width 0.36 mm., ovoid, strongly tapering posteriorly; antennae and legs of the normal form for the genus, the antennal club fairly stout; tarsal claw slender with a single distinct denticle near apex, the claw digitules slender, thread-like, with a tiny knobbed apex extending beyond claw; beak very short conical; with two pairs of thoracic and two pairs of very much smaller abdominal spiracles, these located at the tip of the abdomen and the posterior pair larger; derm with longitudinal rows of small, approximately circular, multilocular disk pores, four rows on each half of the abdomen, and similiar rows of rather large, more or less blackish setae, two rows on each half of the abdomen, many of these appearing somewhat blunted at apices, but this, so far as can be determined, due to injury; marginal setae, particularly near apex of abdomen, somewhat longer than those dorsally; with three pairs of large setae, a little longer than the entire body, at the apex of the abdomen; anal tube with internal double pore collar, and circle of disk pores at mouth, as is usual in the genus; with a single ventral cicatrix.

Adult male.—This is represented by the slide of the various parts in the Maskell collection showing no conspicuous peculiarities, differing, however, from *purchasi* in the greater length of the caudal tassels and the greater prominence of the margins of the penultimate abdominal segment.

Cotypes (larvae).—Cat. No. 25273, U.S.N.M.

As noted by Maskell, the unusual feature of this insect is its close resemblance to *purchasi*. The differences which he indicated in the size, the presence of the large dorsal pencil of secretion, the normally 10-segmented antennae and so on, seem quite sufficient to distinguish the two. The available larvae of *koebelei* are in poor condition and possibly on this account fail to show any distinctive characteristics which might be cited to separate this stage from the corresponding one of *purchasi*. While not intending to revive a subject of some previous controversy, it seems desirable to point out that this species, fully accepted as being indigenous to Australia, appears to possess in common with *I. purchasi*, besides many other points of close similarity, two pairs of adominal spiracles, in contrast to all the other species of *Icerya* known to the writers, three pairs of these being the usual number in the genus.

ICERYA PURCHASI Maskell.

Reference.—Fernald Cat. Cocc. World, 1903, p. 25–27.

The Maskell collection contains slides of this species as follows: One of "females, 3rd stage beginning to form sac, March, 1878" (two adult females); one of "female, early in 3rd stage, March, 1878" (one adult female); one of "young insect from acacia, March, 1878"; one of "male, 1888." The unmounted material is in three lots all bearing No. 95, none of which is definitely recognizable as part of the material on which Maskell based his original description.

In view of the widespread distribution, the characteristic superficial appearance, the numerous figures and descriptions in literature, and the degree of familiarity which the economic importance of this insect has developed in every entomologist, it has not been considered necessary to prepare an extended redescription of it.

In addition to the characteristic appearance of the ovisac and body secretions, and the size and shape of the mature female, the combination of morphological characters possessed by the species, including the presence of only two pairs of abdominal spiracles, the presence of large pores serceting glassy filaments, and the presence of the numerous, conspicuously blackish, long, hair-like setae dorsally, and in rather distinct clusters along the body margin, seems quite sufficient to distinguish this species from any other known to belong in the same genus, with the single exception of *koebelei*, and the differences between these two species have already been discussed.

Subfamily MARGARODINAE.

PLATYCOELOSTOMA, new genus.[8]

Coccids of the Margarodine series as at present recognized; adult female of medium size, elongate oval, convex, segmentation visible, secreting a quantity of cottony matter at the time of oviposition; antennae placed rather close together at apex of body, 10-segmented, tapering gradually from base to apex, the apical longest and slightly stouter; legs of good size and rather short, not unusual for the group, each face of trochanter with several pores; beak wanting (Maskell); with two pairs of thoracic and seven pairs of abdominal spiracles (inferred); derm pores of one sort only, multilocular disk, thin walled, with usually three to five central loculi, encircled by a band of numerous small, half-oval loculi; derm setae of one sort only, rather small, slender setae set in flat, inconspicuous, circular collars; anal opening simple (Maskell); ventral cicatrices not known. Intermediate stage female occurring in waxy cells beneath bark; oval, flattened; with antennae reduced to mere stubs and legs to flat patches of pores and setae; beak small, 2-segmented; with two pairs

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[8] New genera should be credited to the senior author only.

of thoracic and seven pairs of only slightly smaller abdominal spiracles; derm pores of one sort, large, circular, multilocular disk with granular center and a single marginal circle of small loculi; derm setae small, slender, with light basal collar, comparatively few in number; anal opening a simple tube; ventral cicatrices small, numerous, circular, in transverse rows. Larva elongate oval, tapering somewhat anteriorly; antennae nearly contiguous, tapering, 7-segmented; legs not unusual; tarsal digitules with faint knob; beak long conical, 2-segmented; with two pairs of thoracic and (assumed) seven pairs of abdominal spiracles; derm pores of two sorts, ventral as in intermediate stage, dorsal somewhat suggestive of those of adult; body setae few, small, slender; apical pair of setae differentiated but inconspicuous; anal opening apical; with a single, median, posterior ventral cicatrix.

This genus appears to have its proper location among the group including *Steingelia*, *Matsucoccus*, *Stomacoccus*, and *Kuwania*.

The genotype and only included species is the following:

PLATYCOELOSTOMA COMPRESSA (Maskell).

Plate 2, fig. 2.

Reference.—Fernald Cat. Cocc. World, 1903, p. 30.

The Maskell collection contains four slides of this species, as follows: One of "antennae and feet of adult female, 1890," two of "2nd stage female, 1890," and one of "larva, 1891." There are besides a few unmounted specimens of the intermediate stages with No. 140. No other specimens have been available for study.

Adult female.—Nothing could be added to Maskell's description of the external appearance and the general morphological characters of the whole body, as only a portion of one adult, including fore legs, antennae and a very small amount of derm, is available for examination; the derm pores apparently of one type only, multilocular disk with numerous loculi in the outer band and four or five in the central cluster, roughly circular or with more or less distinctly flattened outer faces opposite each of the loculi in the inner cluster; derm setae, so far as can be determined, of one type only; slender, not large, with flat circular collar at base, not abundant; no information regarding the spiracles, anal opening and other abdominal structures available.

Intermediate stage female.—General appearance as described by Maskell; antennae reduced to tiny tubercles, not distinctly segmented, but with faint indications of incomplete joints, bearing a cluster of setae at the apex; legs not entirely wanting, but each represented only by an oval area in the derm bearing clusters of pores and small setae (see figure); beak small, apparently 2-segmented, no traces of a third segment, as indicated by Maskell, observed; with two pairs of

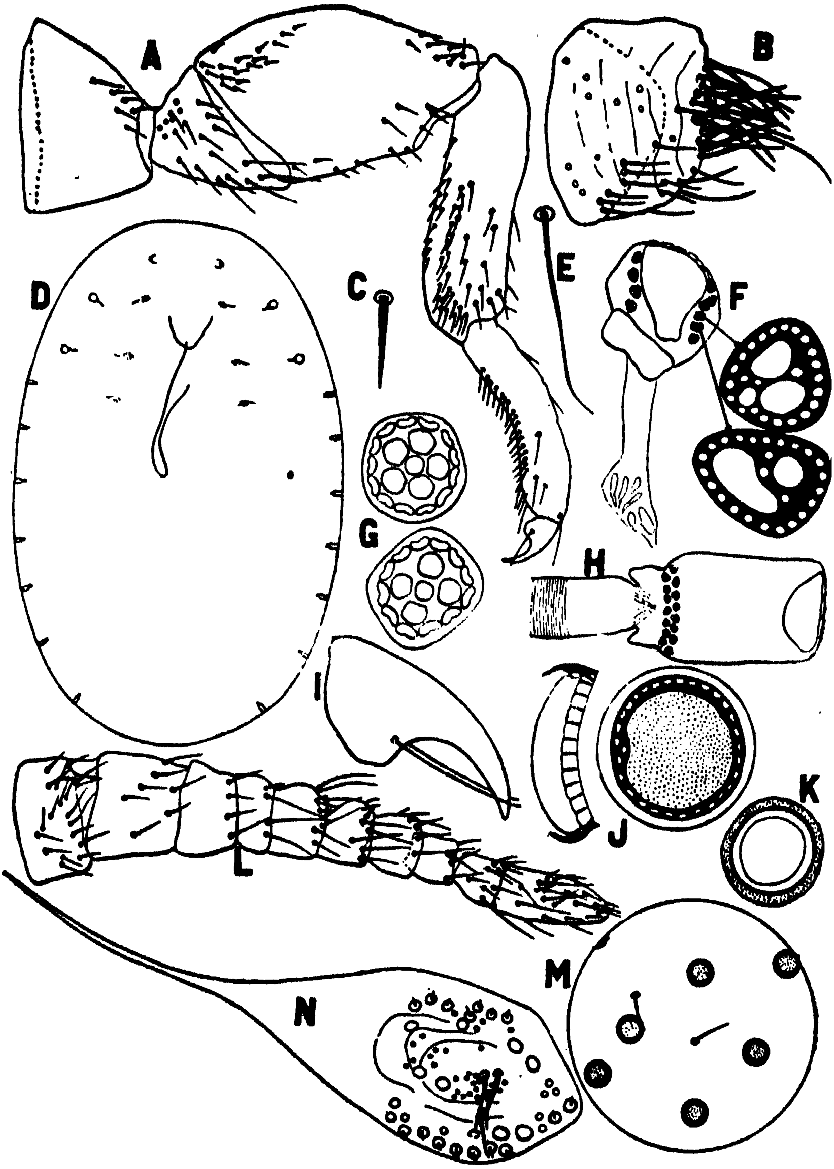

Fig. 16.—Platycoelostoma compressa (Maskell). A, adult female, leg, ×57.5; B, intermediate stage female, antenna, ×500; C, intermediate stage female, seta, ×500; D, intermediate stage female, outline from below, ×17.5; E, adult female, seta, ×500; F, intermediate stage female, thoracic spiracle, ×220, with detail of pores, ×1,500; G. adult female, disk pores, ×1,500; H, intermediate stage female, abdominal spiracle, ×220; I, adult female, claw, ×220; J, intermediate stage female, disk pore, two views, ×1,500; K, intermediate stage female, ventral cicatrix or simple disk pore, ×1,500; L, adult female, antenna, ×57.5; M, intermediate stage female, ventral derm anterior to anal ring, ×220; N. intermediate stage female, middle leg, ×500.

thoracic and seven pairs of abdominal spiracles, the first of different construction, but only slightly larger than the abdominal pairs, all with pore collar, at opening in thoracic, set well in from opening in abdominal spiracles;[9] derm pores of one type only, relatively very large, circular, flat disk pores with large clear centers, apparently slightly granular, and marginal circles of numerous (about 30) small loculi, the outer ring with a slight internal swelling at one point, and an additional still smaller pore in this; derm setae all small, stiff, rather stout, set in a flat circular collar, not numerous, scattered, less abundant than the pores, but, like these, in greater number along the body margin; anal tube small, short, simple; ventral cicatrices all small, some little larger than the pores, in transverse rows of well-separated cicatrices on the abdomen at least, the ends of each row with a cluster of larger ones.

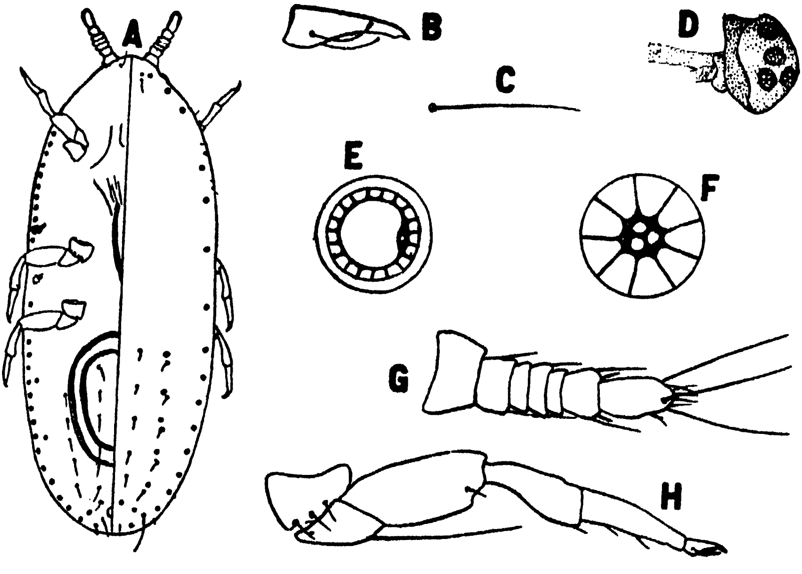

FIG. 17.—PLATYCOELOSTOMA COMPRESSA (MASKELL). LARVA. A, DORSAL AND VENTRAL, ×57.5; B, CLAW, ×640; C, SETA, ×600; D, THORACIC SPIRACLE, ×1,500; E, DISK PORE, ×1,500; F, DISK PORE, ×1,500; G, ANTENNA, ×57.5; H, LEG, ×220.

Larva.—Elongate, posterior apex rounded, anterior somewhat pointed; length 1.115 mm. width .45 mm.; antennae short, distinctly 7-segmented, the intermediate segments very short; legs short, widely separated, tarsal claw with denticle and slender, slightly knobbed digitules extending beyond the apex of the claw; beak long and

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[9] In one of the Maskell slides of this stage, in which the tracheal system has been preserved to a large extent, there may be seen quite plainly an eighth pair of abdominal spiracles, about half the size of the others, and without the pore collar, but with the usual band of small internal hairs. Neither these nor their external openings have been definitely located in any of the other intermediate stage females examined (three). This condition suggests the beginning of a process of suppression in the abdominal spiracles commencing with the apical pair.

slender, tapering, apparently 2-segmented; thoracic spiracles similar in shape to those of intermediate stage, and with similar pores; abdominal spiracles not observable in single specimen available for study; derm with large disk pores of two sorts, dorsally, in definite pattern, with pores somewhat similar to those of adult, at margin ventrally, also definitely arranged, with disk pores similar to those found in the intermediate stages; derm with an occasional long, slender seta, with two longer apical setae, but these short and inconspicuous compared with the total body length, widely separated and each curving inward; anal tube simple, opening apically; with a single median ventral cicatrix near apex of abdomen.

Cotype.—Cat. No. 25274, U.S.N.M.

Genus COELOSTOMIDIA Cockerell.

COELOSTOMIDIA PILOSA (Maskell).

Plate 2, figs. 3, 4.

Reference.—Fernald Cat. Cocc. World, 1903, p. 30.

The Maskell collection includes three slides of this species, having the following data: One of "adult female, 1899," one of "female 2nd stage, 1889," one of "larva, 1889," and besides this a few unmounted specimens under No. 120.

Adult female.—General appearance as described by Maskell; derm clearing completely when treated; antennae 11-segmented; legs not unusual, spines of tibia and tarsus long, slender, apparently much less numerous than in *zealandicum*; mouth parts wanting; with two pairs of thoracic and seven pairs of abdominal spiracles, these similar in general appearance, but the thoracic with a chitinous bar, and not strongly differentiated in size; derm pores of one type, circular to oval multilocular disk, with circular to elongate oval, almost bilocular centers; derm spines slender and hair-like, but stout and expanded at base, very abundant; derm setae also slender, with conical basal collars, these less numerous than the "spines" and in many cases much larger, but varying in size, largest along the body margin; anal tube simple; no ventral cicatrices noted.

Intermediate stage female.—General appearance as described by Maskell; antennae much reduced, triangular, apex rounded, with faint indications of joints near base; apex with a number of spines and hairs; legs similarly reduced, triangular, trochanter with a very long seta below, tarsus much reduced, claw with denticle, the digitules long, slender, with knob at apex; beak short, conical, distinctly 2-segmented, with a membraneous basal portion possibly representing the third segment considered present by Maskell; with two pairs of thoracic and seven pairs of abdominal spiracles, the first about twice as large as the second, all with two or more pores near opening; derm pores of one type only, small, circular, with a large bi-, tri-, or

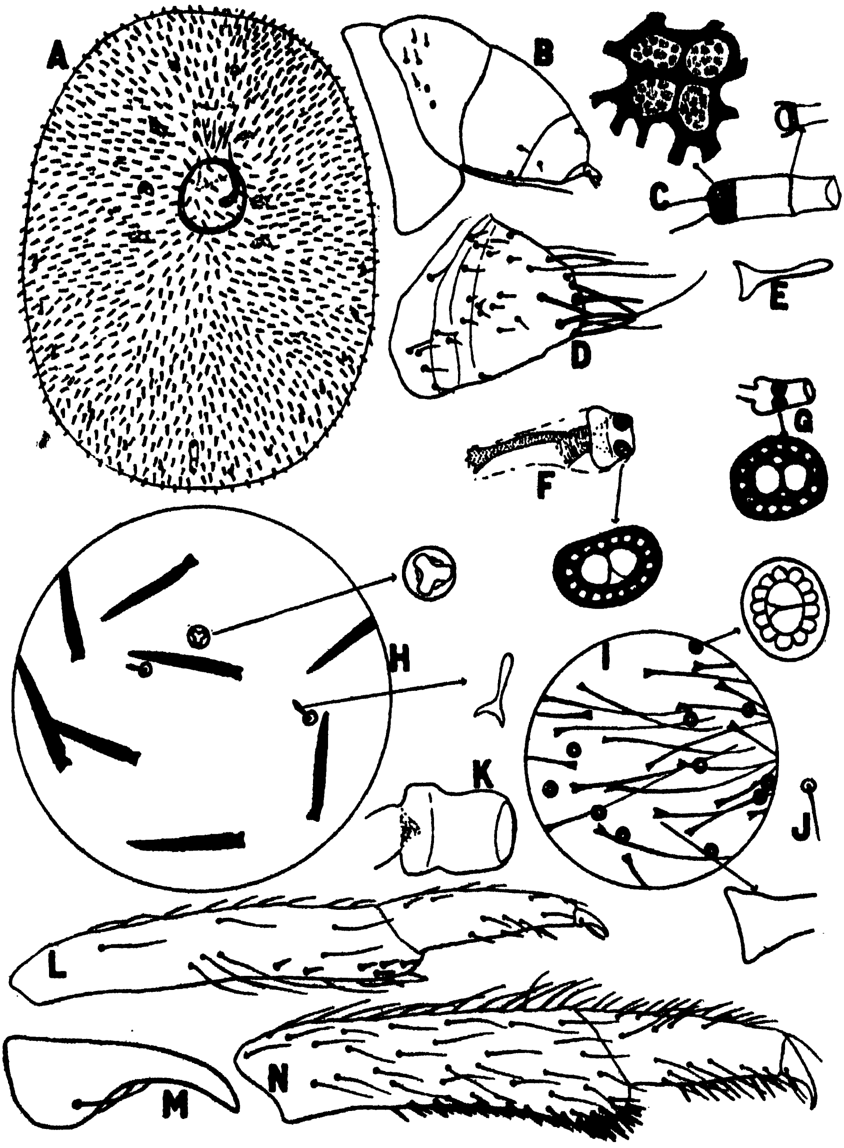

FIG. 18.—COELOSTOMIDIA PILOSA (MASKELL). A, INTERMEDIATE STAGE FEMALE, OUTLINE FROM ABOVE, ×30; B, INTERMEDIATE STAGE FEMALE, LEG, ×220; C, INTERMEDIATE STAGE FEMALE, ANAL TUBE, ×57.5; D, INTERMEDIATE STAGE FEMALE, ANTENNA, ×220; E, INTERMEDIATE STAGE FEMALE, BODY SPINE, ×1,280; F, INTERMEDIATE STAGE FEMALE, THORACIC SPIRACLE, ×220, WITH DETAIL OF PORE, ×1,280; G, INTERMEDIATE STAGE FEMALE, ABDOMINAL SPIRACLE, ×220, WITH DETAIL OF PORE, ×1,280; H, INTERMEDIATE STAGE FEMALE, SECTION OF DERM NEAR MARGIN, ×500, WITH DETAIL OF PORE, ×1,500, AND OF SPINE, ×1,280; I, ADULT FEMALE, SECTION OF DERM, ×220, WITH DETAIL OF PORE AND SPINE BASE, ×1,500; J, INTERMEDIATE STAGE FEMALE, SETA, ×460; K, ADULT FEMALE, ABDOMINAL SPIRACLE, ×220; L, ADULT FEMALE, TIBIA AND TARSUS, ×57.5; M. ADULT FEMALE, CLAW, ×220: N, COELOSTOMIDIA ZEALANDICA (MASKELL), TIBIA AND TARSUS, FOR COMPARISON WITH L, ×57.5.

rarely quadrilocular centers, these less numerous than the stout spines; derm with two sorts of spines, the first large and stout, tapering, with rounded tips, the second much smaller, slender, strongly swollen at bases, tapering to the middle and with the apical half somwhat clavate, these somewhat less numerous than the first; with slender setae with ring-like basal collar, these scattered and less numerous than the preceding; anal tube well developed but not so complicated as in the corresponding stage of *zealandicum*, without pore collar at opening, with a single circle of multilocular disk pores about a third of the length from the apex, and with a broad band of irregular wax pores at inner end; ventral cicatrices present, not numerous for this group, occurring ventrally on both thorax and abdomen, in more or less distinct transverse rows on the latter, these rows ending at each side in a cluster of larger circles, those clusters placed in line posterior to hind legs.

Larva.—Not known. Maskell's slide of "larva, 1889," that of some species of the genus *Pseudococcus.*

Cotype.—Cat. No. 25275, U.S.N.M.

In spite of the existence of a number of rather conspicuous differences between the intermediate stages of this species and *C. zealandica*, they appear to the writers to be probably congeneric. The close similarity in the general appearance of the adults and in the structural characters of the antennae, legs, spiracles, derm pores and setae, and anal tube of this stage of the two species, and the similarity of the general characters of the intermediate stage, such as shape, enclosure within a protective covering, consequent modification of the anal tube, development of numerous cicatrices, reduction of antennae and legs, character of spiracles, and similarity of derm pores, appear to indicate a degree of relationship sufficient, in the present state of our knowledge of the group, to permit the inclusion of these two species in a single genus. The conspicuous differences lie in the intermediate stages in the pronounced development of the derm spines in *pilosior*, the reduction in the chitinization of the derm pores, the much smaller number of cicatrices and the lesser development of the spiracles; and apparently in the adults in the greater number of ventral spines on tibia and tarsus in *zealandica*, and perhaps in other characters. It is very unfortunate that there is no true larva of *pilosa* available for examination, as this stage would help materially in determining the generic relationship existing between these two species. The generic diagnosis previously based on *C. zealandica* at present needs modification only with respect to the derm spines and setae and the anal tube in the intermediate stage female. The statement "no ventral cicatrices" should also be changed, as it is now believed that the large simple circular disk pores correspond to the ventral cicatrices found in some other genera.

COELOSTOMIDIA WAIROENSIS (Maskell).

Reference.—Fernald Cat. Cocc. World, 1903, p. 31.

This species is represented in the Maskell collection by a single slide of "antenna and foot of male, 1896," and by a single unmounted male under No. 99. The few structural characters that have been available for study indicate that this species is not congeneric with the genotype, but a definite reassignment of the species will probably have to wait until it is rediscovered and correctly associated with its female and immature stages.

Genus CALLIPAPPUS Guerin Meneville.

References.—Fuller, Trans. Ent. Soc. Lond., 1899, p. 435.—MacGillivray, The Coccidae, 1921, p. 94.—Froggatt, Sci. Bull. 19, New South Wales Dept. Agr., Oct., 1921, p. 41.

This genus has been discussed in considerable detail in the papers cited above, and since the Maskell material of the three species described by him is very limited and has not been supplemented by specimens of any of the other described species, the writers' studies of this genus have been rather inconclusive.

The writers have not been able, from the available specimens, to establish any distinct morphological differences that might serve as a basis for separating Maskell's three species. Various possible differences along this line are indicated in part in the drawings of comparable areas of the derm of Maskell's three species shown in the figure accompanying the discussion of this genus, but these have not yet been definitely established as tangible specific characters. Certain structural characters, some of rather fundamental importance as indications of the relationship of the genus, that have either not previously been noted or have been incorrectly understood may be remarked upon, however. So far as it goes, Mr. Fuller's discussion of the genus appears to be excellent, but he fails to mention the abdominal spiracles or the character of the derm and its pores and setae in the adult female, the distinctly 2-segmented tarsi in the adult male and the abdominal spiracles and several short lanceolate spines on the intermediate antennal segments in the larva, all of which appear to the writers to possess taxonomic significance. The derm in the adult, except for the invaginated pouch, becomes heavily chitinized, but retains numerous large, clear areolations, each of which has a multilocular disk pore in its center. The abdominal spiracles are fairly large, cylindrical tubes slightly constricted by a band of pores near the inner end. In the one or two specimens where they can be plainly observed, there are eight pairs present in the abdomen, of which the six anterior pairs are approximately uniform in size and appearance, while the seventh pair is considerably reduced,

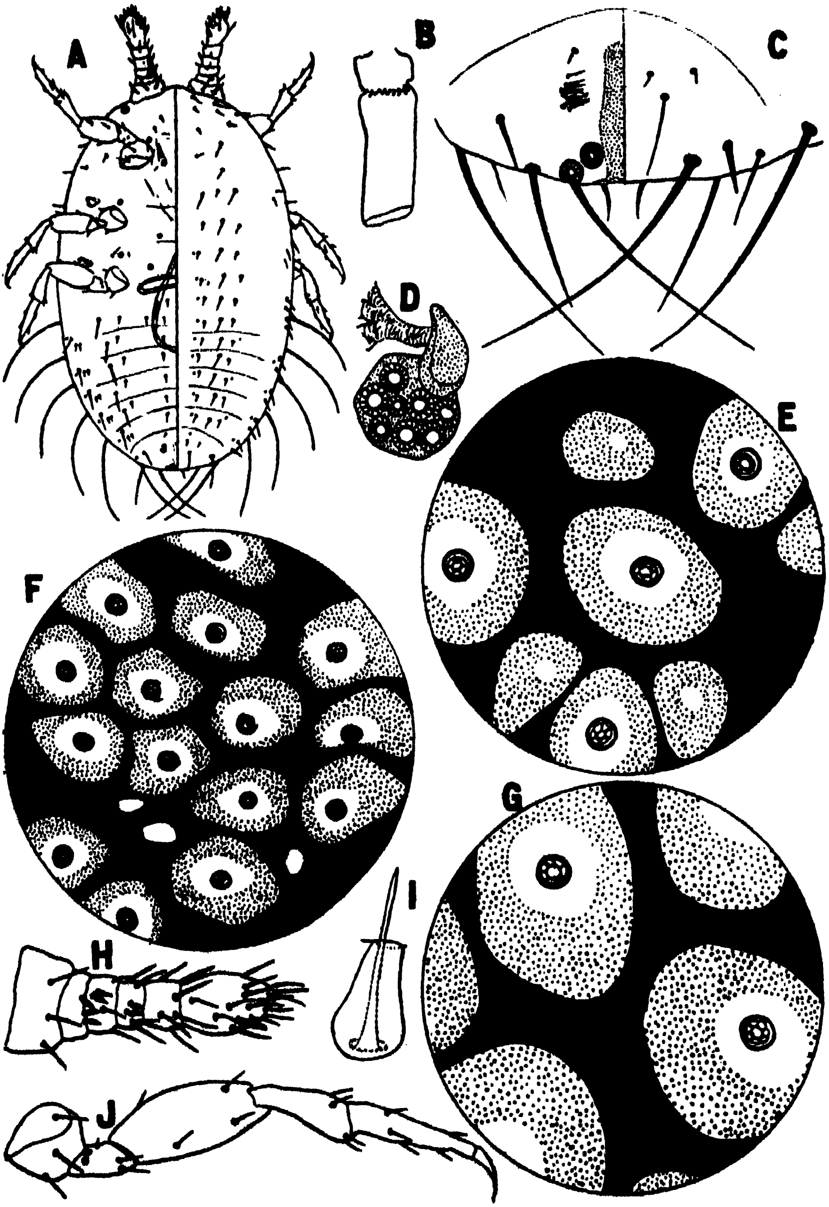

Fig. 19.—Genus Callipappus. A, C. australis (Maskell), larva, dorsal, and ventral, ×57.5; B, same, adult female, abdominal spiracle, ×57.5; C, same, larva, apex of abdomen, dorsal and ventral, ×230; D, same, larva thoracic spiracle, ×540; E, C. immanis (Maskell), adult female, section of dorsal derm, ×220; F, C. rubiginosus (Maskell), same as E, and from comparable area, ×220; G, C. australis (Maskell), same as E, and from comparable area, ×220; H, C. australis, larva, antenna, ×165; I, same, adult female, invaginated seta near inner end of pouch, ×540; J, same, larva, leg, ×165.

but still retains the pore collar, and the eighth pair is much reduced, only a slender, delicate simple tube remaining in the single species in which these can be studied, suggesting the possibility that this pair may be wholly suppressed in some of the other members of the genus. In the larva the spiracles are very minute, simple openings, which have only been located with extreme difficulty, and only seven pairs of such openings have been found thus far. The derm of the adult female bears the large multilocular disk pores already mentioned, these being fairly uniform in size but with centers varying from circular to elongate oval or triangular, and fairly large and stout hairs of variable length, which are more abdundant in particular areas, as near the anterior apex of the body. There are, besides, some unusual setae, invaginated for perhaps half their length, fairly abundant at the inner end of the invaginated sac. The anal tube is simple, slender, and delicate. If the figures given by Signoret for the larva of *C. westwoodi* and by Fuller for *C. bufo* are entirely accurate, it is possible that good morphological characters for the separation of specimens of this stage of the known species may be found in the number and proportional length of the marginal abdominal setae, as these in the larva of *australis*, the only larva available, are long on all the abdominal segments, while as figured in *westwoodi* and *bufo* only those at the apex of the abdomen are long. A tentative key to the species included in this genus, based largely on the information given in Mr. Fuller's paper and quite possibly of little value if put into actual use with specimens collected in the field, has been drawn up and has been supplemented with certain illustrations from Maskell's specimens. Mr. Froggatt has recently (1921) stated that *C. bufo* Fuller is the old final form of one of the other West Australian species, and, as it has not been possible to place it accurately in the key, it has been omitted.

TENTATIVE KEY TO SPECIES OF CALLIPAPPUS.

a^1. External opening of abdominal pouch located ventrally near posterior apex of body (Fuller).................................**westwoodi** Guerin Meneville.
a^2. External opening of abdominal pouch apical, not ventral.
  b^1. Body more or less completely clothed (depending on condition) with brick to orange red, hair-like filaments...................**rubiginosus** (Maskell).
  b^2. Body without such filaments, bare or with whitish waxy or glassy secretion.
    c^1. External opening of abdominal pouch a linear transverse slit **farinosus** Fuller.
    c^2. External opening of abdominal pouch circular to triangular or roughly 8-shaped.
      d^1. Opening roughly 8-shaped; derm coarsely and uniformly punctured **australis** (Maskell).
      d^2. Opening circular to inverted triangular; derm finely punctured **immanis** (Maskell).

The Maskell species are the following:

CALLIPAPPUS AUSTRALIS (Maskell).

Plate 2, fig. 5; plate 3, fig. 1.

Reference.—Fernald Cat. Cocc. World, 1903, p. 31.

This species is represented in the collections in Washington by a fair series of specimens collected in New South Wales by Mr. George Compere, and from these specimens mounts showing the larva as well as the adult and supplying most of the material for the figures on the genus have been obtained.

Cotype.—Cat. No. 25276, U.S.N.M.

CALLIPAPPUS IMMANIS (Maskell).

Plate 3, figs. 2, 3.

Reference.—Fernald Cat. Cocc. World, 1903, p. 31.

Only the few Maskell specimens have been available for examination. The derm aerolation is shown in one of the accompanying figures as well as the character of the external opening of the abdominal pouch.

Cotype.—Cat. No. 25277, U.S.N.M.

CALLIPAPPUS RUBIGINOSUS (Maskell).

Plate 3, figs. 4, 5.

Reference.—Fernald Cat. Cocc. World, 1903, p. 32.

This species is represented in the Maskell collection by the two specimens photographed and by a portion of another, mounted on a slide. The character of the reddish filaments covering the body was not definitely determined from an examination of Maskell's unmounted specimens, but since no comparable structures could be found on the mounted specimens it seems a reasonable assumption that these filaments are secretion from the disk pores over the body and not setae or spines.

Besides the species discussed in the preceding pages, the Maskell collection includes a number of others belonging in these two subfamilies, which it seems desirable to place on record, even if they are not discussed. These are the following: Subfamily Monophlebine, *Guerinielia serratulae* (Fabricius) (No. 93),[10] *Steatococcus townsendi* (Cockerell) (No. 511), *Walkeriana floriger* (Walker) (No. 350), *W. poleii* Green (No. 450), *W. speciosa* Green (No. 394), *Icerya aegyptiaca* (Douglas) (No. 210), *I. crocea* Green (No. 440), *I. natalensis* (Douglas) (No. 114), *I. rileyi* Cockerell (No. 379), and *I. seychellarum* (Westwood) (No. 96); subfamily Margarodinae, *Margarodes formicarum* Guilding (No. 449), *M. vitium* (Giard) (No. 448), *Kuwania zeylanica* (Green) (No. 427), and *Xylococcus filiferus* Loew (No. 89).

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[10] The numbers in parentheses are Maskell collection catalogue numbers.

EXPLANATION OF PLATES.

PLATE 1.

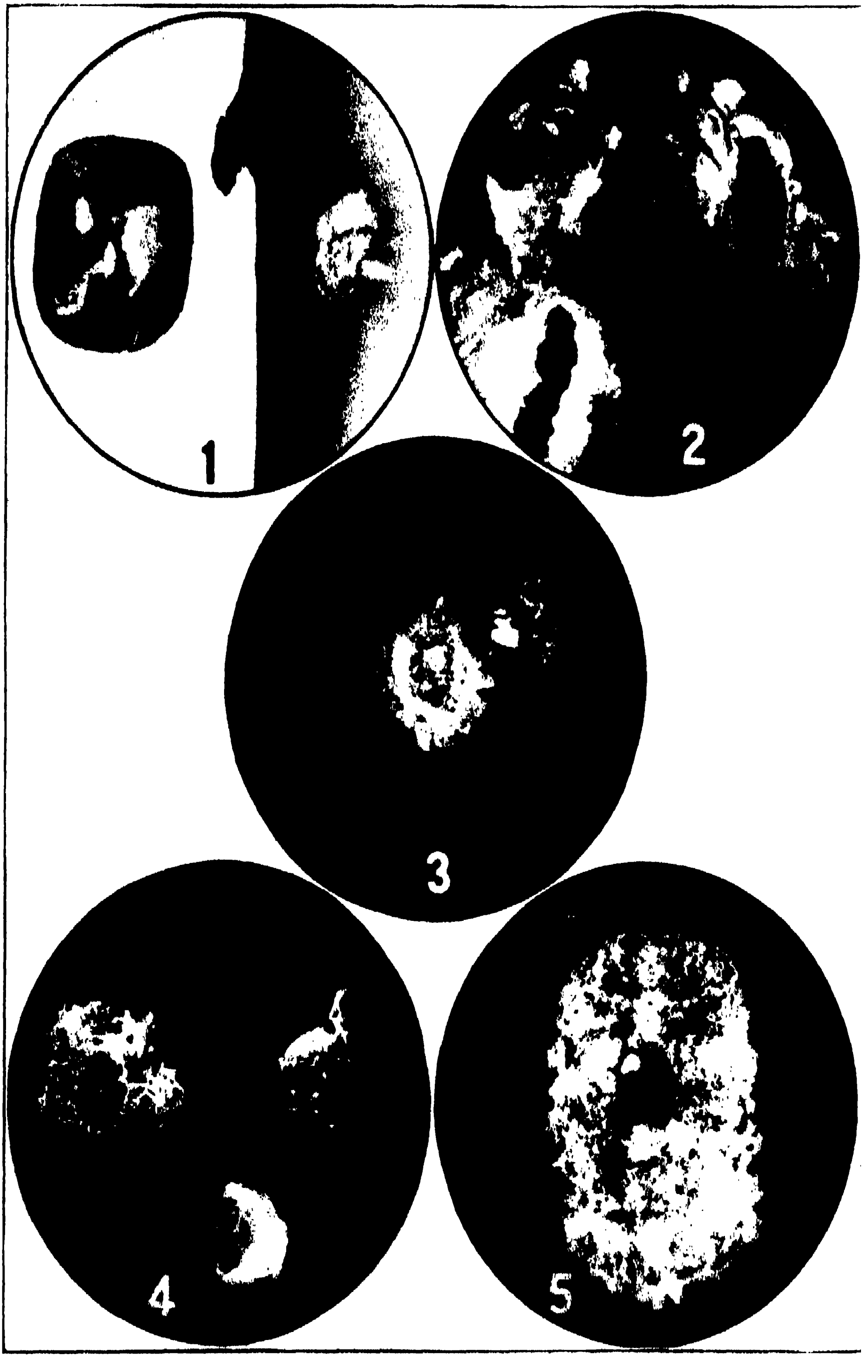
FIG. 1. *Monophlebulus crawfordi* (Maskell), adult female.
2. *Monophlebulus pilosior* (Maskell), adult females.
3. *Monophlebulus comperei*, new species, adult female.
4. *Nodulicoccus levis* (Maskell), adult females.
5. *Auloicerya australis* (Maskell), adult females.

PLATE 2.

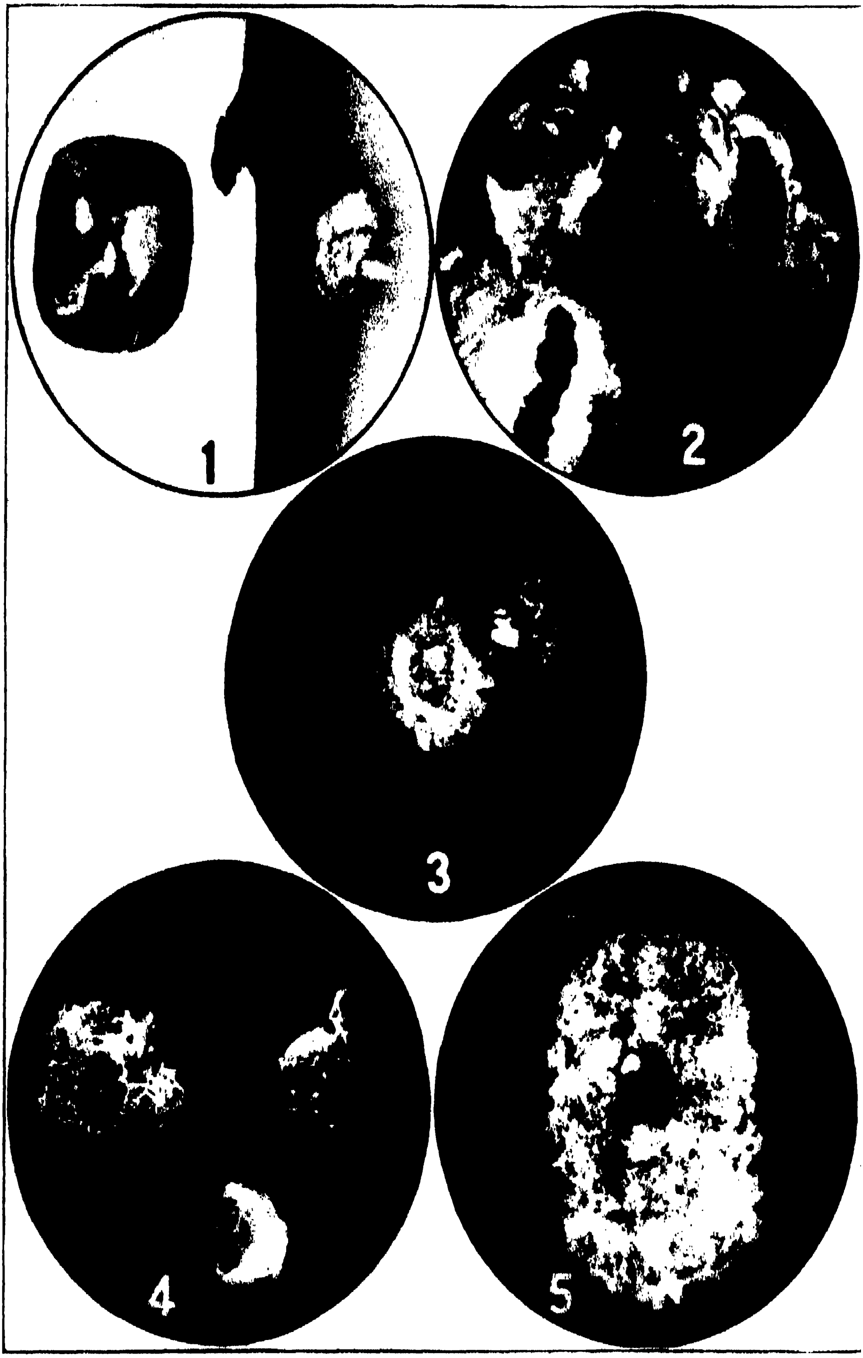
FIG. 1. *Icerya koebelei* Maskell, adult females.
2. *Platycoelostoma compressa* (Maskell), immature female and cells.
3. *Coelostomidia pilosa* (Maskell), adult female.
4. *Coelostomidia pilosa* (Maskell), tests of immature females.
5. *Callipappus australis* (Maskell), adult female.

PLATE 3.

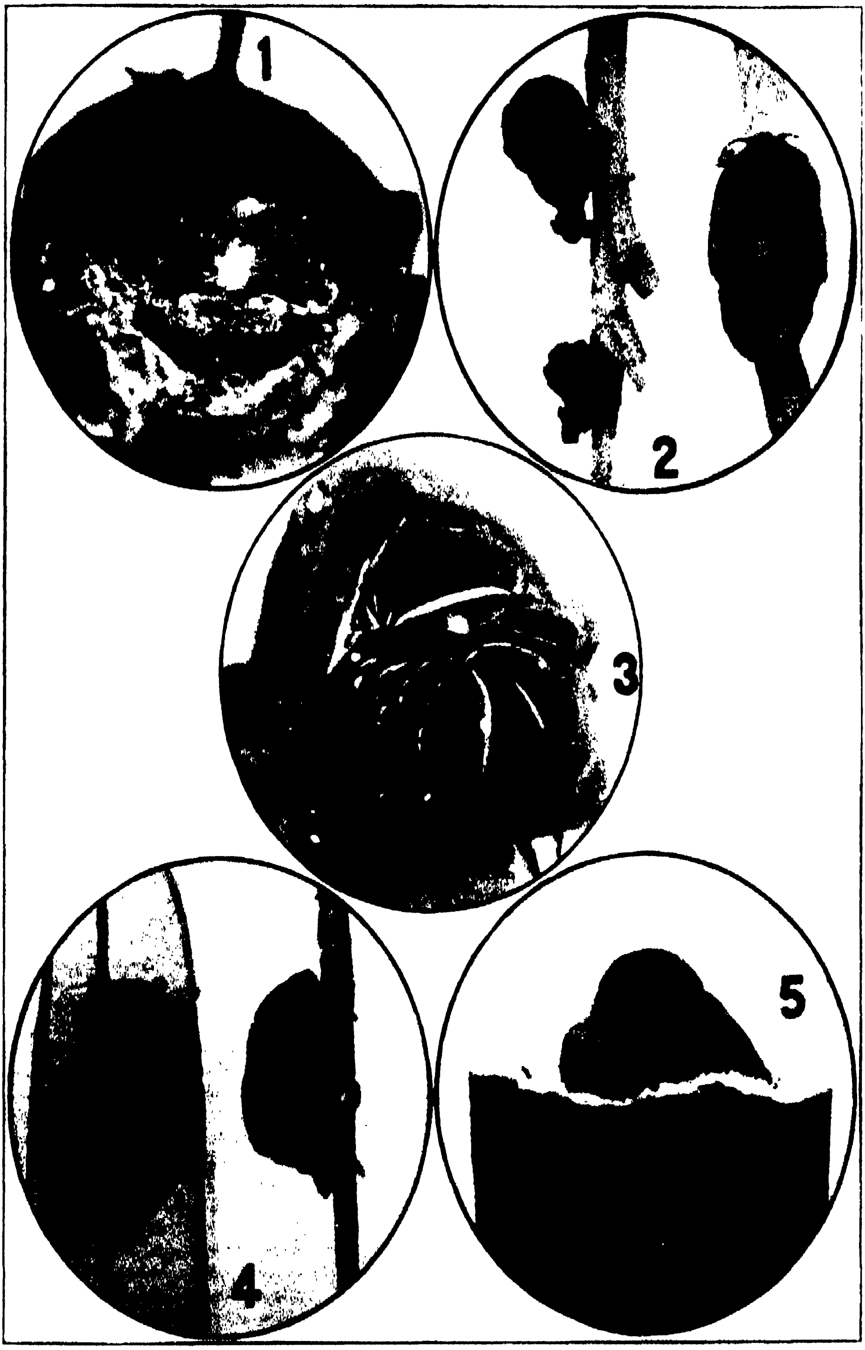
FIG. 1. *Callipappus australis* (Maskell), adult female, apex of abdomen.
2. *Callipappus immanis* (Maskell), adult females.
3. *Callipappus immanis* (Maskell), adult female, apex of abdomen.
4. *Callipappus rubiginosus* (Maskell), adult females.
5. *Callipappus rubiginosus* (Maskell), adult females, apex of abdomen.



MASKELL SPECIES OF MONOPHLEBINAE AND MARGARODINAE.



MASKELL SPECIES OF MONOPHLEBINAE AND MARGARODINAE.



MASKELL SPECIES OF MONOPHLEBINAE AND MARGARODINAE.

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A METEORIC METABOLITE FROM DUNGANNON, VIRGINIA.[1]

By George P. Merrill,

Head Curator of Geology, United States National Museum.

The iron here described was forwarded to the Museum by C. W. Castle, of Nickelsville, Virginia, who reported that it was found while plowing on what is locally known as "Copper Ridge," some 3 miles southeast of Dungannon, Scott County, Virginia. As received, it more nearly resembled an irregular mass of terrestrial limonite than a meteorite, though occasional depressions or thumb markings on the badly oxidized surface suggested its true nature. Oxidation had proceeded so far that in plowing it was broken into two pieces weighing respectively 5 and 23 pounds, or a total of about 13 kilograms. The fractured surface shows plainly an octahedral cleavage. The metal is soft enough to cut readily with a hand hacksaw, contains, so far as observed, no nodules of troilite or schreibersite, and is readily malleable.

The etched surface is unlike that of any iron that has come to my notice (see pl. 1). The octahedral structure is quite indistinct, sometimes almost entirely obliterated. The kamacite bands (gray in figure) are broad, short, and somewhat wavy, while taenite (white) is less conspicuous. The two notable features are (1) a fine granulation which seems to extend irregularly throughout the mass, and (2) the presence, within the kamacite bands, of numerous elongated and oval areas of a dull, lusterless black, a millimeter or so in diameter, which, in turn, enclose minute rounded bits of metal. The form and mode of occurrence is strikingly like that of the schreibersite in the iron of Rosario. By careful treatment of a small piece of the iron in which these were prevalent, I was able to so loosen the texture by partial solution in dilute hydrochloric acid as to allow digging out the material with a needle point. This proved to be a mixture of iron and amorphous carbon. No phosphorus was present. Figures 1 and 2 in Plate 2 show some of these enclosures under a magnification of some 10 diameters, the metal showing in gray, the carbon black. It is unquestionable that the high per cent (0.542) of carbon shown by the analysis is due to these enclosures. Carbon nodules are not unusual in meteoric irons, but, excepting in some photographs of Canon Diablo irons given me by Dr. Arthur Bibbins, I do not recall having before met with this peculiar type. Although containing no evident troilite, the etched surface is lusterless and

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[1] Cat. No. 644, U. S. N. M.

No. 2464—Proceedings U. S. National Museum, Vol. 62, Art. 18.

tarnishes quickly. The granular structure is not as perfect and uniform as in the Roeburne, Australia, iron, but so closely simulates that which may be produced by heating an octahedral iron as to leave no doubt as to its origin, though whether or no the secondary heating was natural or artificial is uncertain. The fact that it was found in a plowed field some distance from the road suggests that it is natural and preterrestrial, and following Berwerth, I will classify it provisionally as a medium octahedrite with granular kamacite lamellae (Omk).

A sample of the iron submitted to Doctor Whitfield yielded:

	Per cent.
Soluble in boiling HCl (1 pt. HCl to 1 pt. H_2O)	98. 92
Insoluble	1. 08

The soluble portion yielded:

	Per cent.
Silicon	0. 015
Phosphorus	0. 130
Nickel	7. 069
Cobalt	0. 090
Iron	92. 69
Total	99. 994

The insoluble portion yielded:

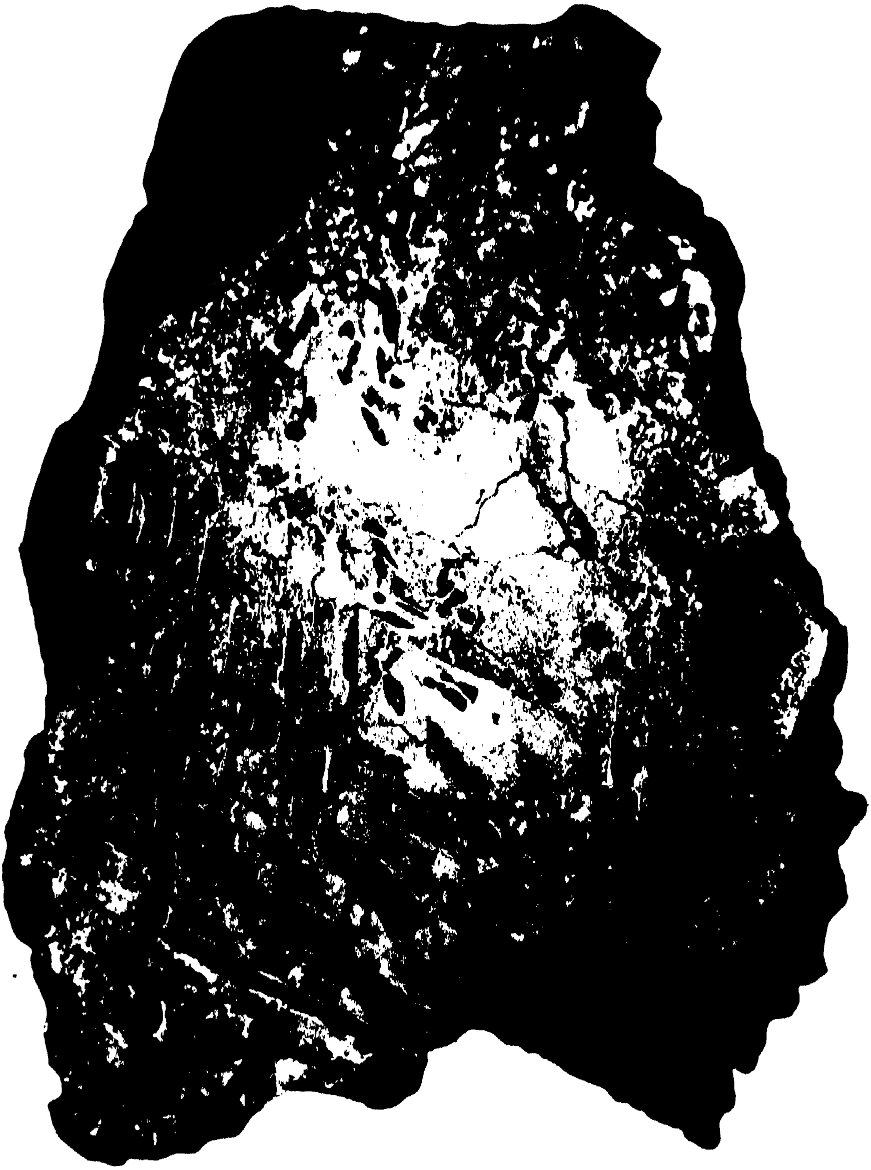
	Per cent.
Phosphorus	11. 564
Nickel and cobalt	38. 89
Iron	49. 00
Carbon	0. 542
Total	99.996

Recalculated, there is obtained for total composition in mass:

	Per cent.
Iron	91. 765
Nickel and cobalt	7. 445
Phosphorus	0. 252
Carbon	0. 532
Silicon	0. 014
Total	100. 008

The unusual feature of the soluble portion is the absence of sulphur, which is an almost universal constituent of meteoric irons. Tests applied to other portions of the 800 gram mass in the Museum collections yielded like results. Chromium and copper were also lacking.

The insoluble portion must be considered schreibersite, low in iron and phosphorus, but correspondingly high in nickel and cobalt. The phosphide in the Cranbourne iron, it will be recalled, gave, according to Flight: Phosphorus, 12.95 per cent; iron, 49.33; nickel and cobalt, 38.24, though the mineral was classed as rhabdite. It is not possible to state what portion of the carbon is free and what combined, but as no cohenite was recognized in the insoluble portion it is probably in large part free, and has been so tabulated above.



POLISHED AND ETCHED SURFACE OF THE DUNGANNON (VA.) METEORIC IRON.

Enlarged about 2 diameters.

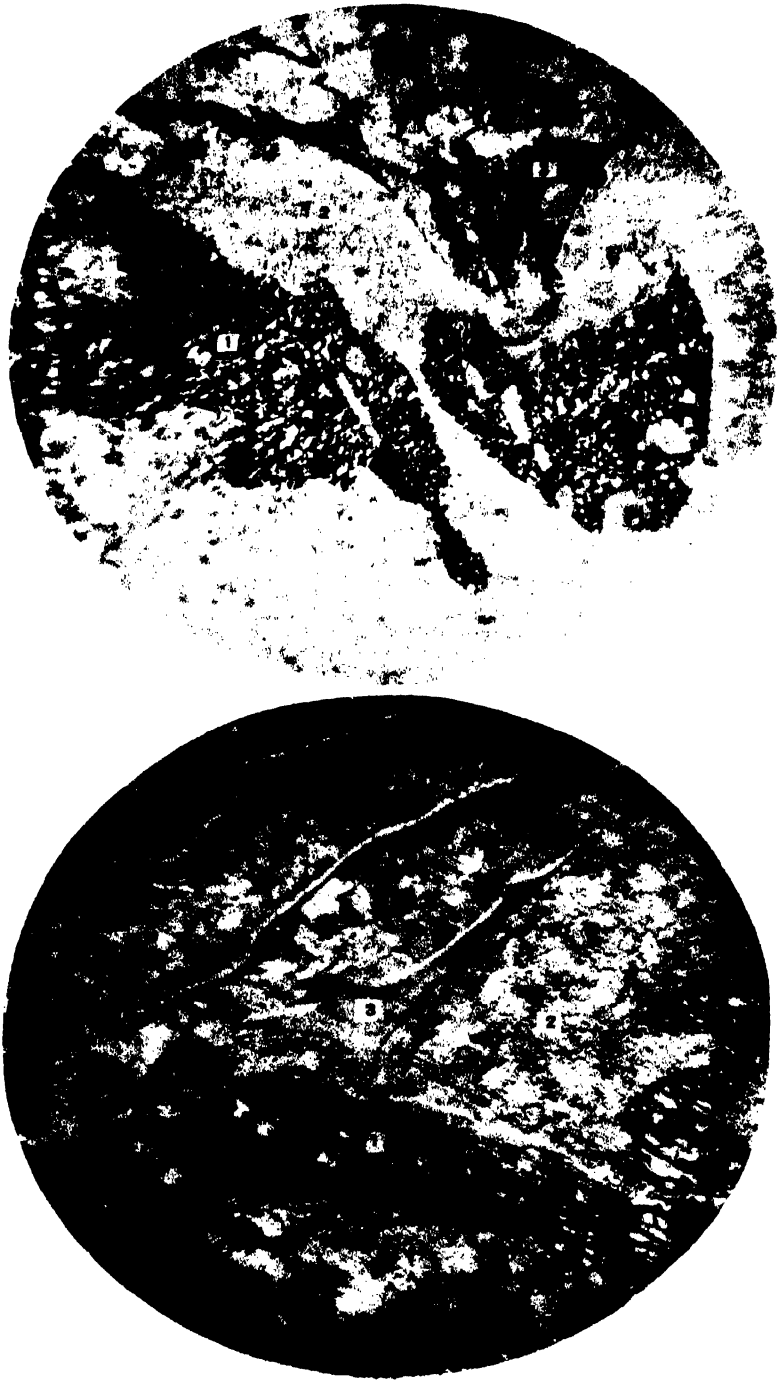


PHOTO-MICROGRAPHS OF THE DUNGANNON (VA.) METEORIC IRON.

Enlarged about 10 diameters.

1. Carbon nodule with included metal. 2. Granular kamacite. 3. Plessite with border of taenite.

MIOCENE PLANTS FROM SOUTHERN MEXICO.

By Edward W. Berry,

Of the Johns Hopkins University, Baltimore.

I am indebted to the Compañia Transcontinental de Petroleo for the collections described in the present paper. They were made by Dr. Bruce Wade from several localities in the vicinity of Palomares in the State of Oaxaca and near San Jose del Carmen in the southeastern part of the State of Vera Cruz, on the Isthmus of Tehuantepec. He informs me that fossil plants are present at several additional localities, as for example Ixhuatlan and Tecuanapa, and that detailed collecting would probably yield from 100 to 150 species. It is much to be hoped that additional collections may become available as the country is opened up by the various oil companies.

The fossil plants described in the present paper possess unusual value despite their limited variety from the fact that they are contained in a shallow water marine series carrying an abundant fauna, and thereby afford opportunities for comparisons between the marine fauna so common throughout tropical America and the scattered florules described by the writer from Panama,[1] the Dominican Republic,[2] Costa Rica,[3] Venezuela,[4] and Haiti.[5] The types have been deposited in the United States National Museum.

The Isthmus of Tehuantepec is a low saddle in the backbone of Central America, nowhere over a hundred meters above sea level and in marked contrast in this respect with the broken country lying to the immediate east and west. It is a region of many lagoons and flooded areas both along both coasts and in the interior. The climate is moist tropical with a mean temperature of about 70°. From September to February the winds are prevailingly northerly and hence cool, bringing rather continuous light rains. The so-called dry season extends over the months of March, April, and May, with

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[1] U. S. Nat. Mus. Bull. 103, pp. 15-44, pls. 12-18, 1918.

[2] U. S. Nat. Mus. Proc., vol. 59, pp. 117-127, pl. 21, 1921.

[3] Idem, pp. 169-185, pls. 22-27.

[4] Idem, pp. 553-579, pls. 107-109.

[5] Idem, vol. 62, art. 14.

No. 2465—Proceedings U. S. National Museum, Vol. 62, Art. 19.

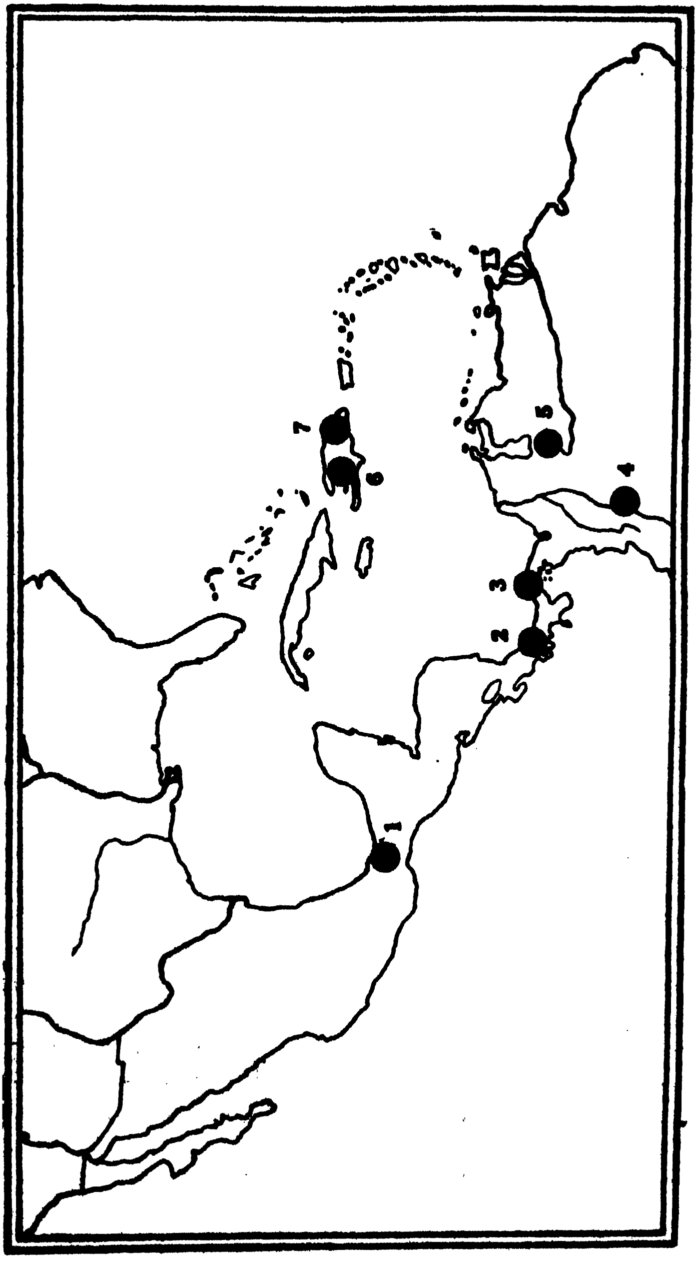
southerly winds and tropical showers, and these increase throughout the summer, nearly every day having its afternoon tropical downpour. Except for the slightly drier belt along the Pacific coast very little of the country is cleared, and then only along the rivers. Most of it, probably about 99 per cent, is tropical rain forest of mixed angiosperms. Some cane, oranges, and cocoa are cultivated and much chicle is gathered, but the population is sparce except along the south coast and in the uplands to the east and west of the low country of the isthmus, and trails are few and poor.

The shores are skirted with thickets of Leguminosae, coco-palms, and Hippomane. Low shores and inlets are covered with mangrove plants (*Rhizophora*, *Avicennia*, *Conocarpus*, etc.) and the less saline marshes abound in *Acrostichum*, *Crescentia*, etc. Prominently represented in the existing flora of the isthmus are various species of the families Lauraceae, Myrtaceae, Anacardiaceae, Anonaceae, Leguminosae, Sapotaceae, Malpighiaceae, and Meliaceae. Species of the following genera are especially characteristic: *Acrostichum*, *Coccolobis*, *Lonchocarpus*, *Haematoxylon*, *Inga*, *Dalbergia*, *Ficus*, *Banara*, *Fagara*, *Cedrela*, *Achras*, *Leucaena*, *Erythrina*, *Crescentia*, and *Exostema*. Six of these genera are represented in the Miocene flora of this region.

The described fossil flora comprises 33 species, all but 4 of which are new. There are 2 ferns, 1 monocotyledon, and 30 dicotyledons. The last represent 11 orders and 20 families. The largest order is the Rosales, with five families and seven species. The orders Geraniales, Thymeleales, and Myrtales follow, with four species each. The largest single family is the Lauraceae, with four species, and the families represented by more than a single species (two each) are the Moraceae, Melastomataceae, Apocynaceae, Bignoniaceae, and Rubiaceae.

The fossil flora, like that of the recent lowland flora of the same region, is essentially South American in its facies. It is strictly tropical except for the presence of Liquidambar fruits, representing a genus still present near by at elevations over 800 meters, and which may have been washed into the basin of sedimentation from Miocene uplands near at hand.

Too little is known about the fossil floras of the Tertiary of tropical America to enable precise age determinations to be made. Intrinsically the flora obviously belongs in the Neogene division of the Tertiary. The only species positively identified which has an outside distribution is *Nectandra areolata* which occurs in Colombia and in the Miocene of Costa Rica. Less certainly determined forms with an outside distribution are *Ficus talamancana* and *Goeppertia tertiaria*, which occur in the Miocene of Costa Rica, and *Guettarda cookei*, which occurs in the Miocene of the Dominican Republic. The fossil floras with which the Tehuantepec flora may be compared are located on the accompanying sketch map.



LOCATION OF DESCRIBED CENTRAL AMERICAN MIOCENE FLORAS.

1. Tehuantepec.
2. Costa Rica.
3. Canal Zone.
4. Santa Ana, Colombia.
5. Merida, Venezuela.
6. Hayti.
7. Dominican Republic.

The associated marine fauna which will settle the age question has received only a preliminary examination. As exemplified by the collection from the marls of Santa Rosa (identified by J. A. Gardner and W. P. Woodring) it comprises 349 species, and suggests a middle Miocene age (Helvetian). Monographic studies of this fauna which are projected may of course modify this tentative opinion somewhat

A brief sketch of the geology of the isthmus was published by Böse [6] in 1906 and in this paper the presence of fossil plants at several localities is mentioned although apparently no collections were made.

Phylum PTERIDOPHYTA.

Class LEPTOSPORANGIATAE.

Order POLYPODIALES.

Family POLYPODIACEAE.

Genus GYMNOGRAMME (of authors).

GYMNOGRAMME WADII, ne

Plate 1, fig. 2.

The absence of fruiting material makes it impossible to determine the exact position of this characteristic fossil fern and I have therefore referred it to what must be regarded as a composite genus, *Gymnogramme*. This type of sterile pinnule is common to a variety of tropical ferns, as for example, *Lomariopsis*, *Blechnum*, etc. The species, which is new, is named for the collector, and may be characterized as follows: Frond pinnate (?). Pinnules large, oblong-lanceolate, subcoriaceous, acuminate at both ends, about 14 cm. in length and 4 cm. in maximum width. Margins somewhat irregular, entire, inclined to be revolute. Midvein wide, not prominent, channeled. Laterals prevailingly simple, closely spaced, parallel, diverging from the midvein at wide angles, approximately 90°, and nearly straight in passing outward to the margins, in which regions they curve slightly upward.

This is a well marked element in the Tehuantepec Miocene flora. Among previously described fossil forms the only one approaching it is *Gymnogramme woodringi* Berry [7] of the Miocene of the island of Haiti. Many recent American forms match it more or less closely.

Occurrence.—Isthmian railroad ¾ km. north of Palomares on Saravia estate, State of Oaxaca; 1½ km. west of telegraph station San Jose del Carmen, State of Vera Cruz.

Holotype.—Cat. No. 36811, U. S. N. M.

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[6] Böse, E., Excursion a l'isthme de Tehuantepec, 10th Int. Geol. Congress, Mexico, 1906.

[7] Berry, E. W., Proc. U. S. Nat. Mus., vol. 62, art. 14.

Genus ACROSTICHUM Linnaeus.

ACROSTICHUM MEXICANUM, new species.

Plate 1, fig. 3.

Frond large, of unknown habit, presumably pinnate. Pinnae thin but coriaceous, lanceolate or oblong-lanceolate in outline. Apex unknown. Base acuminate, sessile. Margins entire, somewhat irregularly undulate. Length unknown, but considerable. Maximum width observed, slightly over 4 cm. Midvein stout and prominent, somewhat flexuous. Venation of the lamina consisting of very thin intricately anastomosing nervilles, the meshes of which in the narrow base of the pinna are elongated parallel with the midvein; higher up they turn outward, forming an angle of about 45° with it.

This obviously new species is represented by the single incomplete specimen figured. It represents a most interesting genus, prominent in coastal floras of the Eocene of the United States, and occurring also during that time in Europe. Several fossil species have been described and these disappear from present day temperate latitudes during the Oligocene. The modern species, as the genus is now understood, are few in number, and comprise in addition to several unimportant Carribbean species, the wide ranging tropical *Acrostichum aureum*, a common coastal species of the mangrove and Nipa swamps, and similar situations, more especially of the less saline and less wet soils of the warmer regions of the world. In America it ranges northward to southern peninsular Florida and southward to southern Brazil, and it is especially common on the Atlantic side of southern Mexico and Central America. In Africa it ranges from Guinea to Natal, and in the Mascarene and Seychelles islands. In the Orient it ranges from southern China to northern Australia and Polynesia. It is most natural as well as gratifying to find it represented by a similar fossil species in the Miocene of southern Mexico.

Occurrence.—Isthmian railroad ¾ km. north of Palomares on Saravia estate, State of Oaxaca.

Holotype.—Cat. No. 36812, U. S. N. M.

Phylum ANGIOSPERMOPHYTA.

Class MONOCOTYLEDONAE.

Order ARECALES.

Family ARECACEAE.

PALM RAYS.

Plate 5, fig. 4.

There are numerous broken rays of a palm in the collection from the Saravia estate. They are small and slender, but whether they are the terminal attenuations of large rays, or belong to a species of feather of fan palm, can not be conclusively determined. Similar broken rays in the muds of estuaries and coastal lagoons are frequent in warm latitudes at the present time.

Occurrence.—Isthmian railroad ¾ km. north of Palomares on Saravia estate, State of Oaxaca.

Holotype.—Cat. No. 36813, U. S. N. M.

Class DICOTYLEDONAE.

Order URTICALES.

Family MORACEAE.

Genus COUSSAPOA Aublet.

COUSSAPOA VERACRUZIANA, new species.

Plate 2.

Leaves of large size, broadly ovate in general outline, widest medianly, with a bluntly pointed tip and a wide cordate base. Margins entire, slightly undulate. Texture coriaceous. Length about 15 cm. Maximum width about 13 cm. Petiole stout, prominent on the under surface of the leaf. Secondaries eight or nine subopposite to alternate pairs, diverging from the midrib at irregular intervals and varying angles ranging from 90° at the base to 20° in the tip of the leaf; they are stout and prominent, and relatively straight in their courses; the basals are short and camptodrome; the next pair likewise camptodrome, are short and give off on their outer sides three or four camptodrome tertiaries; the third pair are long and ascending and suggest incipient lateral primaries, giving off two or three stout camptodrome branches from their outer sides; the remaining secondaries give off stout lateral branches two-thirds of the distance above their bases. The internal tertiaries are relatively stout and well marked on the lower surface of the leaf; they are very closely spaced and largely percurrent at right angles to the secondaries; they frequently anastomose, especially toward the periphery of the leaf, in which region they are slightly more openly spaced. The nervilles are prevailingly at right angles to the tertiaries, are rather well marked, and anastomose to form a very fine mesh.

The present species is exceedingly well marked and also exceedingly like the existing Central American species *Coussapoa ruizii* Klotsch and *Coussapoa villosa* Poeppig and Endlicher. It is also very similar to *Coussapoa villosoides* Berry[3] of the Miocene of

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[3] Berry, E. W., Proc. U. S. Nat. Mus., vol. 59, p. 563, text fig. 2, pl. 108, figs. 1-4, 1921.

Venezuela, differing from the latter in the usually branched condition of the secondaries, in the less stout midrib, in the character of the basal secondaries, and in the tertiary venation of the basal margins. The secondaries are also less regularly spaced, the maximum width is higher above the base, and the tertiaries anastomose more frequently. The material from Tehuantepec is also much more nearly complete than that from Venezuela.

A third fossil species, with a tripalmate primary venation is exceedingly abundant in the Pliocene of eastern Bolivia and will shortly be published. The genus contains about 15 existing species of shrubs and trees, all of which exhibit the characteristic venation exhibited by these fossil forms, even a small fragment being unmistakable. They are confined to the rain forest country between southern Mexico and Brazil and Bolivia

Occurrence.—Small arroya 1½ km. west of telegraph station, San Jose del Carmen, State of Vera Cruz.

Holotype.—Cat. No. 36814, U. S. N. M.

Genus FICUS Linnaeus.

FICUS TALAMANCANA Berry (?).

Plate 3, fig. 7.

Ficus talamancana BERRY, Proc. U. S. Nat. Mus., vol. 59, p. 172, pl. 23, 1921.

Leaves elliptical to broadly lanceolate in general outline, with an apiculate acuminate tip and a decurrent base; of relatively large size. Margins entire and full. Texture subcoriaceous. Length ranging from 12 to 16 cm. Maximum width, in the median region, ranging from 5 to 7 cm. Petiole stout. Midrib very stout, prominent on the under surface of the leaf, relatively narrow on the upper surface. Secondaries eight or nine subopposite to alternate pairs, diverging from the midrib at wide angles of about 75° to 80°, curving regularly but slightly, and camptodrome in the marginal region. Tertiaries thin, forming an open, prevailingly quadrangular, minute areolation, partly consisting of percurrent nervilles.

A single fragment of a leaf unlike anything else in the collection is referred with some hesitation to this species which was founded upon somewhat larger leaves from the Miocene of Costa Rica. In some respects it invites comparisons with the genus *Anona*, and only the collection of more complete material will set the present doubts at rest.

Occurrence.—Isthmian railroad ¾ km. north of Palomares on the Saravia estate, State of Oaxaca.

Plesiotype.—Cat. No. 36815, U. S. N. M.

Order RANALES.

Family ANONACEAE.

Genus ANONA Linnaeus.

ANONA SARAVIANA, new species.

Plate 3, fig. 2.

Leaves of medium size, ovate in general outline, with a broadly ultimately decurrent base, and a conspicuously acuminate tip. The complete specimen figured is markedly inequilateral but whether or not this was a constant character is not determinable. Margins entire, somewhat irregularly flexuous. Length about 10 cm. Maximum width, at or below the middle, about 4.8 cm. Petiole missing. Midrib stout, prominent, and curved. Secondaries thin but prominent, about 10 regularly spaced subparallel pairs diverge from the midrib at angles of from 50° to 60° and are somewhat abruptly camptodrome, particularly toward the apex of the leaf, the lower ones arching more or less along and subparallel with the margins. Tertiaries thin but well marked, forming an open polygonal areolation.

Nearly all of the three score or more existing species of *Anona* are American, ranging from southern peninsular Florida to Brazil, and especially common around the perimeters of the Caribbean. The genus was undoubtedly of American origin and of the score of more of known fossil forms, four well marked species occur in the lower Eocene of the Mississippi embayment region; there is an upper Eocene species in the coastal plain of Texas, and Miocene species are known from Costa Rica and Venezuela. There are also several Miocene and Pliocene species from Peru, Bolivia, and Chile.

This new species is markedly distinct from any of the foregoing, and is rather smaller than most of them. Among recent forms it is surprisingly close to *Anona lutescens* Safford of southern Mexico and Guatemala.

Occurrence.—Isthmian railroad ¾ km. north of Palomares on the Saravia estate State of Oaxaca.

Holotype.—Cat. No. 36816, U. S. N. M.

Order ROSALES.

Family ROSACEAE.

Genus MOQUILLEA Aublet.

MOQUILLEA MEXICANA, new species.

Plate 3, fig. 1.

Leaves obovate, with a bluntly pointed or broadly rounded apex, and cuneate base. Margins entire, full and evenly rounded. Leaf substance thin, but firm and resistant. Petiole missing. Midrib mediumly stout and prominent, somewhat flexuous. Secondaries few in number, thin, four pairs diverge from the midrib at angles of about 45° and sweep upward in broadly ascending curves, subparallel with one another and with the lateral margins of the leaf, they are subacrodrome in appearance and are eventually lost in the gradually diminishing arches along the margins. Tertiaries thin, more or less percurrent. Aerolation fine, polygonal. Length about 6 centimeters. Maximum width about 3 centimeters.

This perfectly characteristic leaf has some features suggestive of the genera *Bumelia* or *Bucida*, but after much search among recent material, it appears to me to be most similar to the genus *Moquillea*. The latter comprises about a score of species of shrubs and trees of tropical South America, one of which extends northward an undetermined distance into Central America. The only other known fossil form is *Moquillea stübeli* described by Engelhardt[9] from the Miocene of Santa Ana in the Magdalena Valley, Colombia. The latter although similar to the Mexican species is more distinctly elliptical in form, but is undoubtedly closely related to it, thus emphasizing once more the South American facies of the Miocene Tehuantepec flora.

Occurrence.—6½ to 7 km. northwest of Palomares, State of Oaxaca

Holotype.—Cat. No. 36817, U. S. N. M.

Family CONNARACEAE.

Genus CONNARUS Linnaeus.

CONNARUS CARMENENSIS, new species.

Plate 3, fig. 6.

Leaves ovate in general outline, widest below the middle and more narrowed distad. Apex acute. Base broadly cuneate. Margins entire, full but somewhat irregularly rounded. Texture subcoriaceous. Length about 10.5 cm. Maximum width about 5 cm. Petiole missing. Midrib stout and prominent, conspicuously thinning distad. Secondaries few and remote, mostly alternate, about four pairs diverging from the midrib at angles of about 45°, curving upward and ascending parallel with the lower lateral margins, sometime forking in the marginal region, and sometimes regularly camptodrome. Tertiaries mostly percurrent but often anastomosing midway between the secondaries. The fine areolation characteristic of the genus is not preserved.

This obviously new species appears to be most closely related to the leaves of the modern species of *Connarus*, although it resembles somewhat the leaves of the Malpighiaceae. The genus *Connarus* has over 50 existing species about equally divided between the Old and New World tropics. In America it is represented from the Antilles to Brazil by trees or high climbing shrubs. I know of no previously described fossil species.

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[9] Abh. Senck. Naturf. Gesell., vol. 19, p. 86, pl. 4, fig. 11, 1895.

Occurrence.—1½ km. west of telegraph station, San Jose del Carmen, State of Vera Cruz; Isthmian railroad ¾ km. north of Palomares on the Saravia estate, State of Oaxaca.

Holotype.—Cat. No. 36818, U. S. N. M.

Order SAPINDALES.

Family ANACARDIACEAE.

Genus ANACARDITES Saporta.

ANACARDITES LANCEOLATUS, new species.

Plate 6, figs. 1, 2.

The genus *Anacardites* of Saporta affords a convenient resting place for fossil leaves of the Anacardiaceae of doubtful generic identity. The present species may be described as follows: Leaves or leaflets of variable size; lanceolate in outline; about equally acuminate at the apex and base, the latter slightly inequilateral in all the specimens seen and this feature is probably to be interpreted as meaning that the fossils are the leaflets of a compound leaf. Margins entire. Texture subcoriaceous. Length ranging from 4 to 8 cm. Maximum width ranging from 11 to 18 mm. Petiole or petiolule short and stout, 2 to 3 mm. in length. Midrib relatively very stout and prominent. Secondaries stout, numerous, closely and regularly spaced, subparallel; they diverge from the midrib at wide angles of from 60° to 70°, curve regularly, but slightly upward, thinning in the marginal region, and losing their identity in one or two camptodrome arches. Tertiaries thin but well marked, largely percurrent. Areolation fine, isodiametric.

This well marked form shows clearly the characters of the Anacardiaceae, and in many respects suggests the genus *Spondias*, which is an exceedingly common one in tropical America.

A considerable number of species have been referred to *Anacardites*, there being six of these in the Eocene of southeastern North America.

Occurrence.—6½ to 7 km. northwest of Palomares, State of Oaxaca.

Cotypes.—Cat. No. 36819, 36844, U. S. N. M.

Family HAMAMELIDACEAE.

Genus LIQUIDAMBAR Linnaeus.

LIQUIDAMBAR INCERTA, new species.

Plate 3, fig. 5.

From the locality near San Jose del Carmen there are five specimens of fruits that are indistinguishable from fruits that I have described under the above name from the Tertiary of the Mississippi embayment.[10] They appear to represent ferruginous mud casts of the capsular cavities with the beaks worn away, and are similar in appearance to specimens from both the European and North American late Tertiary that have been referred to *Liquidambar europaeum* Alex. Braun and *Liquidambar styraciflua* Linnaeus. Their reference to *Liquidambar* is by no means conclusive, and I have suggested this uncertainty in the specific name *incerta*. It is possible that they may represent some unknown form of Moraceae or Rubiaceae. On the other hand *Liquidambar* is a warm temperate type which is still found in southern Mexico above 800 meters, but not in the tropical altitudinal zone. It may be that these fruits were brought down to sea level by streams from some adjacent Miocene upland, which would explain the absence of leaves.

The geological history of *Liquidambar* has been discussed both by the writer[11] and by Laurent.[12] The existing species are four in number and botanically very similar although geographically remote, being segregated in the southeastern United States, the uplands of Central America, Asia Minor, and southeastern Asia.

Occurrence.—1½ km. west of telegraph station San Jose del Carmen, State of Vera Cruz.

Holotype.—Cat. No. 36820, U. S. N. M.

Family MIMOSACEAE.

Genus INGA Willdenow.

INGA MIOCENICA, new species.

Plate 5, fig. 3.

Leaflets relatively small, sessile, broadly lanceolate, slightly falcate, and markedly inequilateral in outline. Apex and base about equally and markedly acuminate. Margins entire. Texture not shown in the limited material collected, although all of the forms collected at this locality are maceration resisting forms. Length about 6 cm. Maximum width, about midway between the apex and the base, about 1.85 cm. One side of the lamina full below and narrowed above, the opposite side narrowed below and full above. Maximum difference in width of the two sides about 2 mm., but this is no measure of the marked inequilateral appearance of these leaflets. Midrib curved and prominent, not stout except proximad where it expands abruptly to the sessile base. Secondaries well marked, of medium size and prominence, seven regularly curved camptodrome ones in the broader half of the lamina; six in the narrower half, the basal of which are straight and ascending, the distal of which are more curved and camptodrome like those of the opposite side. Tertiaries thin, largely percurrent.

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[10] Berry, E. W., U. S. Geol. Survey Prof. Paper 92 (in press).

[11] Berry, E. W., Plant World, vol. 22, pp. 345-352, 1919.

[12] Laurent, L., Ann. Mus. d'Hist. Nat. Marseille, vol. 17, pp. 9-27, 1919.

This distinct type shows very conclusively the foliar features of an *Inga*, many species of which genus have been recognized in recent years in the warmer Tertiary floras of the Western Hemisphere. The present species is not particularly close to any of these, but is, on the other hand, very similar to several Central American and northern South American existing forms. The genus is a large one to which new species are being constantly added. The latest published enumeration [13] lists 9 species from Mexico, and their variety increases southward, 14 being listed from Panama and Colombia, 29 from Peru, and 66 from Brazil. The genus, although present, is much more sparingly represented in the Antilles than on the mainland. The known fossil Miocene species of this general region comprise one from Colombia,[14] one from Panama,[15] one from Costa Rica,[16] and one from the Dominican Republic.[17]

Occurrence.—1½ km. west of the telegraph station San Jose del Carmen, State of Vera Cruz.

Holotype.—Cat. No. 36821, U. S. N. M.

Family PAPILIONACEAE.

Genus DIOCLEA Humboldt, Bonpland, and Knuth.

DIOCLEA (?) MEXICANA, new species.

Plate 1, fig. 4.

Leaflets broadly lanceolate in outline; widest in the middle or slightly below the middle; slightly more tapering distad than proximad; about equally acute at both ends. Margins entire, full and evenly rounded. Texture subcoriaceous. Length about 7.5 to 8 cm. Maximum width about 3 cm. or slightly more. Petiolule not preserved. Midrib stout. Secondaries very thin, numerous, ascending, camptodrome. Tertiaries obsolete.

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[13] Pittier, H., Cont. U. S. Nat. Herb., vol. 18, pt. 5, 1916.

[14] Engelhardt, H., Abh. Senck. Naturf. Gesell., vol. 19, p. 36, pl. 8, figs. 1, 2; pl. 9, fig. 8, 1895.

[15] Berry, E. W., U. S. Nat. Mus. Bull. 103, p. 32, pl. 16, fig. 2, 1918.

[16] Berry, E. W., Proc. U. S. Nat. Mus., vol. 59, p. 174, pl. 25, fig. 2, 1921.

[17] Idem., p. 120, pl. 21, fig. 11.

In some of its features this form suggests such a lauraceous genus as *Mespilodaphne* but the secondaries are more numerous and much less prominent and the character of their endings is leguminous and not lauraceous. Among the great variety of the former alliance the present species appears to resemble the genus *Dioclea* more closely than any of the others. This genus consists of about 20 existing species of high climbing shrubs, mostly South American, but represented in Central America. The only previously described fossil species known to me is a broader ovate one from the Aquitanian of Carniola.[18]

The genus is still sparingly represented in the oriental tropics.

Occurrence.—Isthmian railroad ¾ km. north of Palomares on the Saravia estate, State of Oaxaca.

Holotype.—Cat. No. 36822, U. S. N. M.

LEGUMINOSAE INCERTAE.

Genus LEGUMINOSITES Bowerbank.

LEGUMINOSITES MEXICANUS, new species.

Plate 4, fig. 1.

Leaflets short petiolulate; ovate and inequilateral in outline; widest below the middle, narrowing upward to a short angular tip; wide and rounded at the base. Margins entire. Texture coriaceous. Length about 3.25 cm. Maximum width about 2.5 cm. Petiolule short, stout and curved, expanded proximad, 2 mm. or less in length. Midrib stout, prominent on the under side of the leaflet, becoming thin distad. Secondaries thin but well marked; eight or nine pairs diverge from the midrib at wide angles, pursue rather straight outward courses, and are camptodrome. Tertiaries obsolete because of the alteration of the leaf substance since burial to a carbonaceous film which slacked in drying.

This appears to me to represent a leguminous leaflet, and the following genera in which certain of the species have very similar leaflets may be enumerated: *Cassia*, *Dalbergia*, *Erythrina*, *Leptolobum*, *Machaerium*, *Pithecolobium*, and *Pterocarpus*. I have no doubt that the fossil represents one of these genera and with better preserved and more abundant material it might be possible to reach a decision. If a guess were permitted I would say it represented either a *Dalbergia* or an *Erythrina*, meanwhile it is referred to the form-genus *Leguminosites*.

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[18] Ettingshausen, C. von, Foss. Fl. von Sagor, pt. 2, p. 46, pl. 19, figs. 6–8, 1877.

Occurrence.—1½ km. west of the telegraph station San Jose del Carmen, State of Vera Cruz.

Holotype.—Cat. No. 36823, U. S. N. M.

LEGUMINOSITES OAXACENSIS, new species.

Plate 3, fig. 3.

A flat, narrow, several seeded leguminous pod, prominently margined, of unknown length, about 8.5 mm. wide, the valves coarsely reticulate veined, the seeds lenticular.

This fragment is of unknown botanical affinity and might represent one of many diverse genera of the leguminous alliance. Although probably not of any especial significance the Mexican fossil is much like fragments described by Engelhardt from Loja, Ecuador, as *Leguminosites machaerioides*, *grandis*, and *cassioides*.[10]

Occurrence.—Isthmian railroad ¾ km. north of Palomares on the Saravia estate, State of Oaxaca.

Holotype.—Cat. No. 36824, U. S. N. M.

Order GERANIALES.

Family RUTACEAE.

Genus FAGARA Linnaeus.

FAGARA WADII, new species.

Plate 1, fig. 5.

Leaflets practically equilateral, of medium size, orbicular to elliptical in general outline, being widest in the middle and approximately equally rounded at the apex and base. Margins entire. Texture subcoriaceous. Length ranging from 3.7 to 5 cm. Maximum width ranging from 2.6 to 3.3 cm. Petiolule short, stout, and expanded, about 2 mm. in length. Midrib stout, prominent on the lower surface of the leaflet. Secondaries mediumly stout, five or six subopposite to alternate pairs; these are somewhat unequally paced, subparallel with one another and with the lower lateral margins of the leaflet; they become more ascending and more curved in apical region, arching along the margins, with camptodrome endings. The tertiaries are thin, partially obsolete, those seen are percurrent.

This species conforms closely to the leaves of the existing species of *Fagara* and to some of the abundant fossil forms of the Oligocene of the southern United States, the genus, often confused with its derivative *Zanthoxylon*, appears in the Cretaceous of southeastern North America, and remains a member of the flora of that region throughout the Eocene, Oligocene, and lower Miocene. The present species is not unlike *Fagara catahoulensis orbiculata* Berry,[20] but shows its distinctness in its more numerous, thinner secondaries, its elliptical instead of orbicular form, and indistinct areolation. It also resembles somewhat the antecedent *Fagara claibornensis* Berry[21] and *Fagara petraflumensis* Berry[22] of the middle and upper Eocene. The existing species of Fagara number over 150 shrubs and trees, cosmopolitan in the warmer parts of the world and including a number of distinctly coastal types.

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[10] Engelhardt, H., Abh. Senck. Naturf. Gesell., vol. 19, p. 22, pl. 3, figs. 7-9b, 1895.

Occurrence.—Isthmian railroad ¾ km. north of Palomares on Saravia estate; 100 meters east of old trans-Isthmian road and Arroya Limon, 6½ km. northwest of Palomares, State of Oaxaca.

Holotype.—Cat. No. 36825, U. S. N. M.

Family EUPHORBIACEAE.

Genus DRYPETES Vahl.

DRYPETES ELLIPTICA, new species.

Plate 7, fig. 5.

Leaves small, elliptical in general outline; widest medianly and narrowed about equally to the similarly rounded apex and base, the latter slightly broader than the former. Margins entire. Texture subcoriaceous. Length about 5.5 cm. Maximum width about 2.7 cm. Petiole missing. Midrib stout. Secondaries stout, widely spaced, about five subopposite pairs; they diverge from the midrib at wide angles and form wide camptodrome arches some distnace within the margins. Tertiaries forming successive arches in the marginal region; internally forming open polygonal meshes. Areolation fine, quadrangular or polygonal, isodiametric.

This type of leaf makes its appearance in the fossil record in the lower Eocene of the Mississippi embayment region and has continued to exist in the Caribbean area from that time to the present. The existing species number about a dozen, ranging from southern peninsular Florida to Brazil The fossil is not unlike the leaves of the existing white wood, *Drypetes keyensis* Urban, a considerable tree of south Florida and the Antilles. It is also not unlike the Wilcox species *Drypetes prekeyensis* Berry[23].

Occurrence.—Isthmian railroad ¾ km. north of Palomares on the Saravia estate, State of Oaxaca.

Holotype.—Cat. No. 36826, U.S.N.M.

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[20] Berry, E. W., U. S. Geol. Survey Prof. Paper 98, p. 240, pl. 59, figs. 1–3, 1916.

[21] and [22] Berry, E. W., Idem., 92 (in press).

[23] Berry, E. W., U. S. Geol. Survey Prof. Paper 91, p. 258, pl. 56, fig. 4, 1916.

Family MELIACEAE.

Genus CEDRELA Linnaeus.

CEDRELA MIOCENICA, new species.

Plate 7, fig. 1.

Leaflets sessile, lanceolate-falcate, widest at or below the middle, narrowing upward to the acute tip, and downward to the acuminate base. Margins entire. Texture coriaceous. Length about 8 cm. Maximum width about 1.7 cm. Midrib stout, prominent, curved. Secondaries thin, numerous, subparallel, camptodrome. Tertiaries not visible in the collected material.

This species, which is obviously new, represents a leaflet of a pinnate leaf, of a form rather commonly referred to the genus Sapindus by paleobotanists. It appears to me, however, to be more properly compared with *Cedrela*. The latter genus has about a dozen existing species, confined to the American tropics, and largely on the mainland of Central and South America. The only known American fossil species are those described by me from the Eocene of southeastern North America.

Occurrence.—1½ km. west of the telegraph station, San Jose del Carmen, State of Vera Cruz.

Holotype.—Cat. No. 36827, U.S.N.M.

Family SIMARUBACEAE.

Genus SIMARUBA Aublet.

SIMARUBA VERACRUZIANA, new species.

Plate 7, fig. 6.

Leaflets sessile (?), elliptical in general outline, with a rounded base and an abruptly acuminate tip. Margins entire, evenly rounded. Texture coriaceous. Length about 5 cm. Maximum width, midway between the apex and the base, about 2.6 cm., the one half of the lamina slightly wider than the other, and the tip markedly inequilateral. Midrib stout, curved, prominent on the under side of the leaflet. Secondaries thin, largely immersed, numerous, closely and fairly regularly spaced; they diverge from the midrib at wide angles of between 60° and 70°, pursue practically straight subparallel courses outward and have their tips connected by an arching marginal vein. Areolation not visible in the collected material.

There is some doubt regarding the generic reference of this species because of the limited amount of material and the general similarity to the leaves of certain genera of tropical American Myrtaceae and Sapotaceae.

The genus *Simaruba* in the existing flora contains a limited number of species of arborescent forms, confined to the Americas, where they range from southern Florida through the Antilles to Brazil, and extend northward from South America in the *tierra caliente* of Central America. Fossil species have seldom been recognized, but these include a species in the lower Eocene of southeastern North America[24], a second and very conclusively identified form in the Miocene of Venezuela,[25] and a third in the Miocene of the Island of Haiti.[26]

Occurrence.—1½ km. west of the telegraph station, San Jose del Carmen, State of Vera Cruz.

Holotype.—Cat. No. 36828, U.S.N.M.

Order RHAMNALES.

Family RHAMNACEAE.

Genus GOUANIA Linnaeus.

GOUANIA MIOCENICA, new species.

Plate 7, fig. 4.

Leaves of medium size, widest medianly, elliptical-ovate in general outline. Apex bluntly pointed. Base broadly rounded, the margins forming a wide, scarcely perceptible angle where they join the top of the petiole. Leaf substance thin. Margins entire for a greater or less distance above the base, becoming gradually and increasingly undulate distad, until in the upper half of the leaf they are coarsely and regularly crenate-undulate. Length about 6 cm. , Maximum width about 4.25 cm. Petiole missing, presumably short. Midrib thin, but prominent. Secondaries six subopposite to alternate pairs, they are thin but prominent and diverge from the midrib at angles ranging from about 55° in the basal pair to 25° in the distal pair; all curve regularly upward subparallel with one another and with the lower lateral margins of the leaf; they ascend in sweeping curves which brings the distal ends of the proximal pair well above the middle of the leaf, and are ultimately camptodrome. The basal secondaries give off on their outer sides four or five sweepingly curved camptodrome tertiaries. The second pair of secondaries also frequently give off laterally one or two similar but smaller camptodrome tertiaries. The enclosed tertiaries are thin, closely spaced, well marked, percurrent nervilles such as commonly characterize the leaves of this family.

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[24] Berry, E. W., U. S. Geol. Survey Prof. Paper 91, p. 252, pl. 54, fig. 7, 1916.

[25] Berry, E. W., Proc. U. S. Nat. Mus., vol. 59, p. 573, pl. 109, fig. 2, 1921.

[26] Berry, E. W., Idem, vol. 62, art. 14, p. 6, pl. 1, fig. 8, 1922.

The genus is otherwise unknown in the fossil state except for two very similar species described by Engelhardt [27] from a probably similar Miocene horizon in the Magdalena valley of Colombia. The existing species number more than 40, mostly climbing shrubs, and occur in all tropics, but fully half of that number are peculiar to the rain forest country of the Amazon basin and adjacent regions.

Occurrence.—Isthmian railroad ¾ km. north of Palomares on the Saravia estate, State of Oaxaca.

Holotype.—Cat. No. 36829, U. S. N. M.

Order THYMELEALES.

Family LAURACEAE.

Genus NECTANDRA Roland.

NECTANDRA TEHUANTEPECENSIS, new species.

Plate 1, fig. 6.

Leaves of medium size, lanceolate in outline, somewhat falcate, widest medianly and equally acutely pointed at the apex and base. Margins entire. Texture coriaceous. Length about 9 to 10 cm. Maximum width 3.8 cm. Petiole stout, its length unknown. Midrib stout, prominent on the under side of the leaf, curved. Secondaries stout, prominent, subparallel, and camptodrome about 10, mostly alternate, regularly spaced pairs diverge from the midrib at angles of about 45°, sweeping upward in ascending regular curves. With the exception of a few percurrent nervilles the tertiaries are obsolete by immersion.

This is a typical *Nectandra*, very similar to several existing and fossil species. Among the latter it is not unlike *Nectandra gosportensis jacksonensis* Berry [28] of the upper Eocene of the Gulf border of the United States, and may possibly represent a more southern Miocene survivor of that form.

The existing species of *Nectandra* number about 70 and are confined to the tropical and subtropical parts of the Western Hemisphere. They, along with other members of the family Lauraceae are especially massed in the rain forests of northern South America, and this South American facies, recognized in the existing flora of the Mexican lowlands, appears to have been foreshadowed during the Tertiary.

Occurrence.—Isthmian railroad ¾ km. north of Palomares on the Saravia estate, State of Oaxaca.

Holotype.—Cat. No. 36830, U. S. N. M.

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[27] Engelhardt, H., Abh. Senck. Naturf. Gesell., vol. 19, pp. 23, 24, pl. 4, figs. 4-7, 1895

[28] Berry, E. W., U S. Geol. Survey Prof. Paper 92 (in press).

NECTANDRA AREOLATA Engelhardt.

Plate 4, fig. 3.

Nectandra areolata ENGELHARDT, Abh. Senck. Naturf. Gesell., vol. 19, p. 29, pl. 6, figs. 1, 2, 1895.—BERRY, Proc. U. S. Nat. Mus., vol. 59, p. 177, pl. 27, 1921.

Leaves of large size, elliptical acute in general outline, widest in the middle and equally pointed at both ends. Margins entire slightly undulate. Texture coriaceous. Length about 18 cm. Maximum width about 7.5 cm. Petiole short and stout, about 1 cm. in length. Midrib stout, prominent on the under side of the leaf. Secondaries stout proximad, becoming thin distad, prominent on the lower surface of the leaf; 8 to 10 somewhat irregularly spaced pairs diverge from the midrib at angles of 45° or more, and curve regularly upward, ending in camptodrome arches along the margins. Tertiaries well marked, percurrent. Areolation open, polygonal.

This species was described by Engelhardt from the Miocene of Santa Ana, Colombia, and compared with the existing *Nectandra gardneri* Meissner. It was based upon rather imperfect material, but more complete specimens were subsequently described by the present writer from the Miocene of Costa Rica. It is common in the Tehuantepec Miocene and tends to strengthen the conviction that the Colombia, Costa Rica, and south Mexican beds are very similar in age.

Occurrence.—Isthmian railroad ¾ km. north of Palomares on the Saravia estate, State of Oaxaca.

Plesiotype.—Cat. No. 36831, U. S. N. M.

Genus MESPILODAPHNE Nees.

MESPILODAPHNE PALOMARESENSIS, new species.

Plate 1, fig. 1.

Symmetrical ovate-lanceolate leaves of small to medium size, widest medianly and about equally acuminate at the apex and base; with evenly curved, entire margins; and subcoriaceous texture. Length about 7 cm. Maximum width about 2.75 cm. Petiole stout, presumably long, but preserved for only a short distance. Midrib stout, prominent, straight. Secondaries mediumly stout, regularly spaced, subparallel and camptodrome; about seven subopposite pairs diverge from the midrib at angles of about 55° or 60°, curving regularly upward. The areolation is indistinctly preserved.

Among previously described fossil forms this species falls naturally in the group which includes *Mespilodaphne pseudoglauca* Berry and *Mespilodaphne coushatta* Berry of the lower Eocene of southeastern North America[30]. It is quite possible that this Miocene species of southern Mexico represents a southward restriction of descendants of these Eocene forms. It is also similar to *Mespilodaphne hispaniolana* Berry of the Miocene of the Island of Haiti[30]. It is much like numerous existing species of *Mespilodaphne*. The genus contains numerous existing species confined to the American tropics.

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[30] Berry, E. W., U. S. Geol. Survey Prof. Paper 91, pp. 306, 307, pl. 89, figs. 4, 6; pl. 87, fig. 3, 1916.

Occurrence.—Isthmian railroad ¾ km. north of Palomares on the Saravia estate, State of Oaxaca.

Holotype.—Cat. No. 36832, U. S. N. M.

Genus GOEPPERTIA Nees.

GOEPPERTIA c.f. TERTIARIA Berry.

Plate 5, fig. 5.

Goeppertia tertiaria BERRY, Proc. U. S. Nat. Mus., vol. 59, p. 176, pl. 25, fig. 1, 1921.

Leaves of medium size, elliptical oval in general outline, widest below the middle, with an acute tip and a rounded base. Margins entire, full and evenly rounded. Texture coriaceous. Length about 12 cm. Maximum width about 5.75 cm. Petiole missing. Primaries three, supra basilar, all prominent on the lower surface of the leaf, the midrib stoutest; the laterals diverge from the midrib about 5 mm. above its base, at acute angles of about 25°, curving upward. Secondaries comprise a few camptodrome pairs in the tip of the leaf, several broadly curved ascending ones from the outer sides of the lateral primaries, and an opposite pair from near the base of the midrib. The tertiaries are thin and percurrent, or inosculate midway between the primaries or secondaries and primaries. Areolation a fine polygonal lauraceous mesh.

This is a type commonly referred to *Cinnamomum* and I know of no certain characters for distinguishing certain species of *Goeppertia* and *Cryptocarya* from that genus, and am therefore inconsistent in not adhering to custom. The present species is very similar to several species of *Goeppertia*, a genus with numerous existing species confined to the American tropics, and I am also influenced by the large number of almost exclusively tropical American species of the tribe *Cryptocaryeae* that have leaves of the *Cinnamomum* type. The present species was described originally from the Miocene of Costa Rica and is represented by a single, slightly smaller fragment in the Mexican Miocene, which is certainly very closely allied to, if not identical with, the Costa Rican type.

Occurrence.—Isthmian railroad ¾ km. north of Palomares on the Saravia estate, State of Oaxaca.

Plesiotype.—Cat. No. 36833, U. S. N. M.

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[30] Berry, E. W., Proc. U. S. Nat. Mus., vol. 62, art. 14.

Order MYRTALES.

Family MYRTACEAE.

Genus MYRCIA DeCandolle.

MYRCIA SARAVIANA, new species.

Plate 5, fig. 1.

Leaves small, ovate-lanceolate and falcate; widest below the middle and tapering upward to the acuminate tip, and downward to the acute base. Margins entire, slightly undulate. Texture subcoriaceous. Length about 3.5 cm. Maximum width about 1 cm. Petiole missing. Midrib stout, curved. Secondaries numerous, approximately straight, subparallel; diverging from the midrib at wide angles, their tips connected by a slightly arched, acrodrome marginal vein.

The present species may be readily matched by the leaves of several existing species of this genus. Among previously described fossil forms it appears to be most similar to *Eugenia ovalifolia* Engelhardt[31], described from the Tertiary basin of Loja in Ecuador. *Myrcia* was present around the shores of the Gulf of Mexico and the Caribbean from the Upper Cretaceous to the present, and a considerable number of fossil forms have been described in recent years. The existing species number over 400 and are confined to the American tropics, being especially massed in northern South America.

Occurrence.—Isthmian railroad ¾ km. north of Palomares on the Saravia estate, State of Oaxaca.

Holotype.—Cat. No. 36834, U. S. N. M.

Family LECYTHIDACEAE.

Genus LECYTHIDOPHYLLUM, new genus.

LECYTHIDOPHYLLUM COURATARIOIDES, new species.

Plate 6, figs. 3, 4.

Leaves of large size, obovate and somewhat inequilateral in general outline, widest above the middle. Apex abruptly and bluntly angular. Base cuneate, markedly inequilateral. Margins entire, somewhat undulate. Texture subcoriaceous. Length about 17 cm. Maximum width about 7 cm. Petiole stout, its length unknown. Midrib stout and prominent. Secondaries stout, about nine subopposite pairs diverge from the midrib at angles of about 55°, curving regularly upward, subparallel and ascending, arching close to the margins until their identity is lost in the tertiary areolation. Tertiaries thin, very closely spaced, obliquely and irregularly percurrent, curving and inosculation in an intricate fashion, and connected by cross nervilles, forming lanceolate meshes whose long axes are at an angle of about 60° with the midrib.

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[31] Engelhardt, H., Abh. Senck. Naturf. Gesell., vol. 19, p. 16, pl. 1, fig. 14, 1895.

Although the type material is somewhat broken the peculiar venation stamps this form as a distinct type in this flora, and one that is clearly referable to the family Lecythidaceae. In the presence of some doubt as to the most closely related existing genus of this peculiar and interesting family I have proposed the form genus *Lecythidophyllum* for its reception. The family is essentially South American but *Grias*, *Couroupita*, *Japarandiba*, and perhaps others occur in Central America. Very few fossil forms have been compared with the existing members of this family. The genus *Couratari* Aublet is represented in the Miocene of Ecuador[32] by a form not very dissimilar from the present species, and a species of *Lecythis* has been described from the lower Miocene of Chile.[33] The present occurrence represents, as far as I know, the first record of a fossil member of the family outside of South America.

Occurrence.—Isthmian railroad ¾ km. north of Palomares on the Saravia estate, State of Coxaca.

Cotypes.—Cat. No. 36835, 36845, U. S. N. M.

Family MELASTOMATACEAE.

Genus MELASTOMITES Unger.

MELASTOMITES ANGUSTUS, new species.

Plate 6, fig. 5.

Leaves of small size, lanceolate in outline, widest below the middle and acuminate at both ends, the apex being slightly more narrowed than the base. Margins entire. Texture subcoriaceous. Length about 5 cm. Maximum width about 1.2 cm. Apparently sessile. Midrib curved, relatively very stout. Lateral primaries one on each side, thin, suprabasilar, acrodrome; connected with the midrib by numerous, closely spaced, approximately straight nervilles; giving off on the outside numerous thin camptodrome branches.

This small leaf, although not unlike forms frequently referred to the genus *Cinnamomum* of the Lauraceae, is considered by me to represent the family Melastomataceae, which is such an extensive modern family and so largely developed in the American tropics. None of the few fossil forms that have been recognized are similar to the present species. The genus is present near the Oligocene-Miocene boundary in Panama and in the Miocene of the Dominican Republic.

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[32] Engelhardt, H., Abh. Senck. Naturf. Gesell., vol. 19, p. 24, pl. 2, figs. 3-4a, 1895.

[33] Engelhardt, H., Idem., vol. 16, p. 677, pl. 10, fig. 1, 1891.

Occurrence.—8 km. west of Palomares at the head of Arroya Zapote, State of Oaxaca.

Holotype.—Cat. No. 36836, U. S. N. M.

MELASTOMITES OBOVATUS, new species.

Plate 6, fig. 6.

Leaves relatively short and broad, obovate or subelliptical and somewhat inequilateral in general outline; with broadly rounded apex and slightly narrowed base. Margins entire. Texture subcoriaceous. Length about 4.5 cm. Maximum width about 2 cm. Apparently sessile. Primaries five, thin, subequal, diverging from the base of the leaf at acute angles and acrodrome; the outer ones marginal; connected by nearly straight, transverse nervilles.

This species is based upon a sparse amount of material rather indifferently preserved, but it shows clearly the characters of the leaves of this large, tropical, and mostly American family. Its exact generic relationship is uncertain, and like the preceding lanceolate species it is referred to the form genus *Melastomites*.

Occurrence.—Isthmian railroad ¾ km. north of Palomares on the Saravia estate, State of Oaxaca; 1½ km. west of the telegraph station, San Jose del Carmen, State of Vera Cruz.

Holotype.—Cat. No. 36837, U. S. N. M.

Order GENTIANALES.

Family APOCYNACEAE.

Genus APOCYNOPHYLLUM Unger.

APOCYNOPHYLLUM MEXICANUM, new species.

Plate 4, fig. 2.

Leaves oblong-lanceolate in outline, more tapering distad than proximad. Apex more acute than the base. Margins entire, full and evenly rounded. Texture coriaceous. Length about 12 cm. Maximum width about 3.2 cm. Petiole missing. Midrib very stout and prominent. Secondaries relatively thin, numerous, widely spaced; about 12 pairs diverge from the midrib at wide angles of about 65°, are relatively straight for two-thirds of the distance to the margins, and then curve rapidly upward and are camptodrome; the lower ones arching along the margins from the ends of the percurrent tertiaries; the upper ones more abruptly camptodrome. Tertiaries mostly obsolete.

In so far as the present species furnishes diagnostic characters these indicate the family Apocynaceae, but, as is commonly the case among the members of this family, generic characters are not clearly differentiated in the leaves. The species is hence referred to the convenient form genus *Apocynophyllum*, which has many described species. None of these merit especial comment in the present connection.

Occurrence.—1½ km. west of the telegraph station, San Jose del Carmen, State of Vera Cruz.

Holotype.—Cat. No. 36838, U.S.N.M.

Genus ALLAMANDA Linnaeus.

ALLAMANDA CARMENENSIS, new species.

Plate 7, fig. 2.

Leaves of medium size; broadly lanceolate in outline; widest medianly, and tapering equally to the similarly acute apex and base. Margins entire, full and evenly rounded. Texture subcoriaceous. Length about 12 cm. Maximum width about 4 cm. Petiole missing. Midrib stout, straight and prominent. Secondaries thin, numerous, equally spaced, subparallel; they diverge from the midrib, alternately, at angles of about 45°, sweep upward in long ascending curves, and end camptodromely. Tertiaries obsolete.

This characteristic leaf is clearly referable to the Apocynaceae, and its resemblance to the leaves of the existing species of *Allamanda* appears to warrant its reference directly to that genus instead of to the form genus *Apocynophyllum*. *Allamanda* comprises about a dozen existing species of trees or shrubs, the latter often climbing in habit. Their range extends from the Antilles and Central America to Brazil, and they are especially characteristic of the South American tropical rain forest. The only previously described fossil species is a somewhat similar one from the lower Miocene of Chile.[34]

Occurrence.—1½ km. west of the telegraph station, San Jose del Carmen, State of Vera Cruz.

Holotype.—Cat. No. 36839, U.S.N.M.

Order PERSONALES.

Family BIGNONIACEAE.

Genus CRESCENTIA Linnaeus.

CRESCENTIA CI

Plate 5, fig. 2.

Leaves obovate in general outline, with acute tip, and gradually narrowed, cuneate base. Margins entire. Texture subcoriaceous. Length about 13.5 cm. Maximum width, above the middle, about 5.25 cm. Petiole missing. Midrib prominent on the under side of the leaf, stout, curved. Secondaries stout, widely spaced, about six pairs, diverging from the midrib at angles of about 55°, curved, ascending, camptodrome. Tertiaries thin, usually well marked, arching along the margins, generally straight internally, forming with the intermediates from the midrib subparallel with the secondaries, an open isodiametric mesh, becoming percurrent distad.

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[34] Engelhardt, H., Abh. Senck. Naturf. Gesell., vol. 16, p. 658, pl. 6, fig. 4, 1891.

This species, which is represented by a half a dozen broken specimens is almost exactly like the leaves of the existing *Crescentia cucurbitina* Linnaeus, a small coastal tree which ranges from southern peninsular Florida through the Antilles, and from southern Mexico to Panama and Venezuela. This resemblance has suggested the specific name of the fossil. The genus has six or seven existing species and has not previously been recognized in the fossil state. It is confined to America between the latitudes of southern Florida and Brazil.

Occurrence.—Isthmian railroad ¼ km. north of Palomares on the Saravia estate, State of Oaxaca.

Holotype.—Cat. No. 36840, U.S.N.M.

Genus BIGNONOIDES, new genus.

Proposed for the winged seeds of any generically undeterminable member of this family. At present with the features of the single type species described below.

BIGNONOIDES ORBICULARIS, new species.

Plate 3, fig. 4.

Seeds compressed, round in outline and lenticular in cross section, about 3 mm. in diameter; located at the center of a circular wing which is faintly and radially veined and has a more or less irregular margin, the whole about 1.25 cm. in diameter.

A great many genera both in this and other families have superficially similar winged fruits. This is especially true of the family Malpighiaceae which is so largely developed in tropical America. None of these, so far as I know, have a central seed and continuous radial wing. On the other hand there are certain genera of the Bignoniaceae, such as *Callichlamys*, *Jacaranda*, etc., in which some of the modern species have seeds like those of the fossil, which has influenced the present identification. The term for the present genus would preferably be *Bignonites*, but this has already been used by Saporta for a form from the Oligocene of Aix, afterward changed to *Rhopalospermites* and transferred to the Proteaceae.

Among previously described fossil forms the only one deserving of mention is one from the Tertiary of the Loja basin in Ecuador which Engelhardt described [35] as *Banisteria aceroides*. This is very similar in appearance, but not exactly identical with the Tehuantepec fossil.

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[35] Engelhardt, H., Abh. Senck. Naturf. Gesell., vol. 19, p. 14, pl. 2, figs. 18, 19, 1895.

Occurrence.—Isthmian railroad ¾ km. north of Palomares on the Saravia estate, State of Oaxaca.

Holotype.—Cat. No. 36841, U.S.N.M.

Order RUBIALES.

Family RUBIACEAE.

Genus RONDELETIA Plumier.

RONDELETIA, (?) species.

Plate 7, fig. 3.

This fragment scarcely warrants an attempt at a diagnosis or a specific name. It is distinct, however, from the other elements in the Tehuantepec Miocene flora, and its numerous, straight, parallel, ascending secondaries, and peculiar tertiary venation make it easy to recognize and suggest that it represent a fossil species of the genus *Rondeletia.*

This genus comprises about 60 existing species of shrubs and trees, confined to the American Tropics, and largely represented in the Antilles with about 35 species, and in Central America with about 25 species. It is sparingly represented in northern South America. The only known fossil species known to me is one found in the Gatun formation of Panama.[36]

Occurrence.—Isthmian railroad ¾ km. north of Palomares on the Saravia estate, State of Oaxaca.

Cat. No. 36842, U. S. N. M.

Genus GUETTARDA Endlicher.

GUETTARDA COOKEI Berry (?).

Guettarda cookei Berry, Proc. U. S. Nat. Mus., vol. 59, p. 125, pl. 21, figs. 5, 6, 1921.

Fragmentary specimens representing the genus *Guettarda* are tentatively referred to this species which was described recently from the Miocene of the Dominican Republic. The genus contains about 50 existing species found chiefly in tropical America, and the present fossil species appears to be most like the existing *Guettarda elliptica* Swartz of the Antilles.

Occurrence.—Isthmian railroad three-fourths kilometer north of Palomares on the Saravia estate, State of Oaxaca.

Cat. No. 36843, U. S. N. M.

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[36] Berry, E. W., U. S. Nat. Mus. Bull. 103, p. 42, pl. 18, fig. 3, 1918.

EXPLANATION OF PLATES.

PLATE 1.

FIG. 1. *Mespilodaphne palomaresensis* Berry.
2. *Gymnogramme wadii* Berry.
3. *Acrostichum mexicanum* Berry.
4. *Dioclea* (?) *mexicana* Berry.
5. *Fagara wadii* Berry.
6. *Nectandra tehuantepecensis* Berry.

PLATE 2.

FIG. 1. *Coussapoa veracruziana* Berry.

PLATE 3.

FIG. 1. *Moquillea mexicana* Berry.
2. *Anona saraviana* Berry.
3. *Leguminosites oaxacensis* Berry.
4. *Bignoneides orbicularis* Berry.
5. *Liquidambar incerta* Berry.
6. *Connarus carmenensis* Berry.
7. *Ficus talamancana* Berry (?).

PLATE 4.

FIG. 1. *Leguminosites mexicanus* Berry.
2. *Apocynophyllum mexicanam* Berry.
3. *Nectandra areolata* Engelhardt.

PLATE 5.

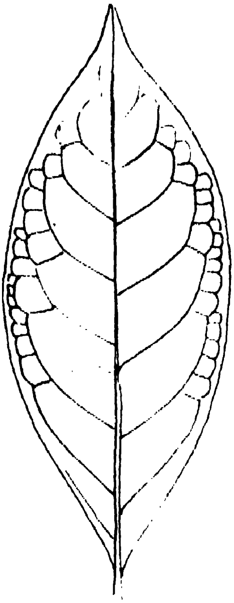
FIG. 1. *Myrcia saraviana* Berry.
2. *Crescentia cucurbitinoides* Berry.
3. *Inga miocenica* Berry.
4. Ray of a palm.
5. *Goeppertia* c. f. *tertiaria* Berry.

PLATE 6.

Figs. 1, 2. *Anacardites lanceolatus* Berry.
3, 4. *Lecythidophyllum couratarioides* Berry
5. *Melastomites angustus* Berry.
6. *Melastomites obovatus* Berry.

PLATE 7.

FIG. 1. *Cedrela miocenica* Berry.
2. *Allamanda carmenensis* Berry.
3. *Rondeletia*, (?) species.
4. *Gouania miocenica* Berry.
5. *Drypetes elliptica* Berry.
6. *Simaruba veracruziana* Berry.



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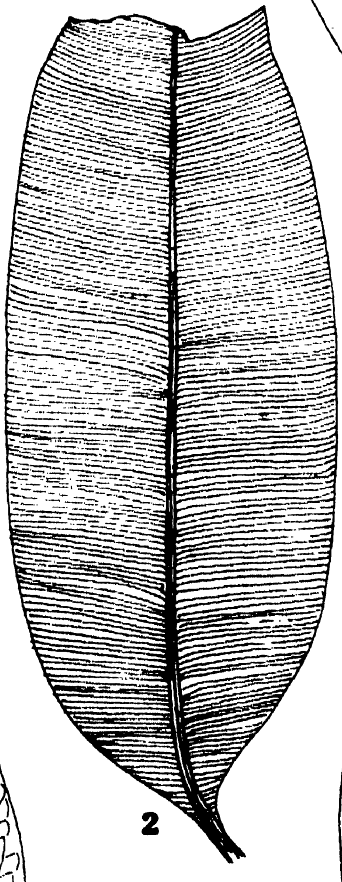

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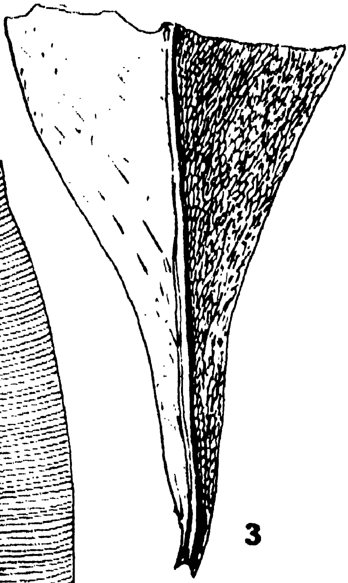

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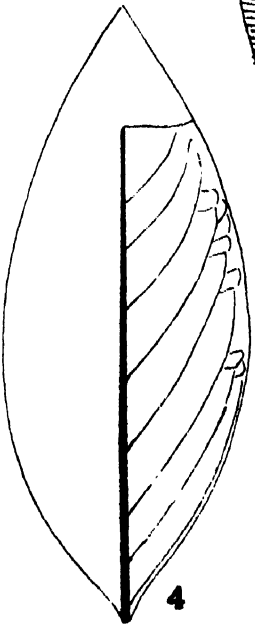

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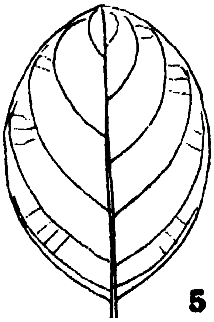

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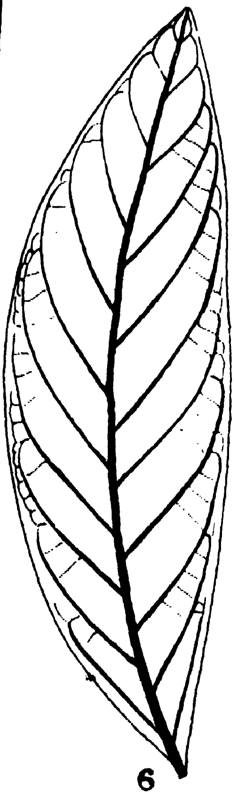

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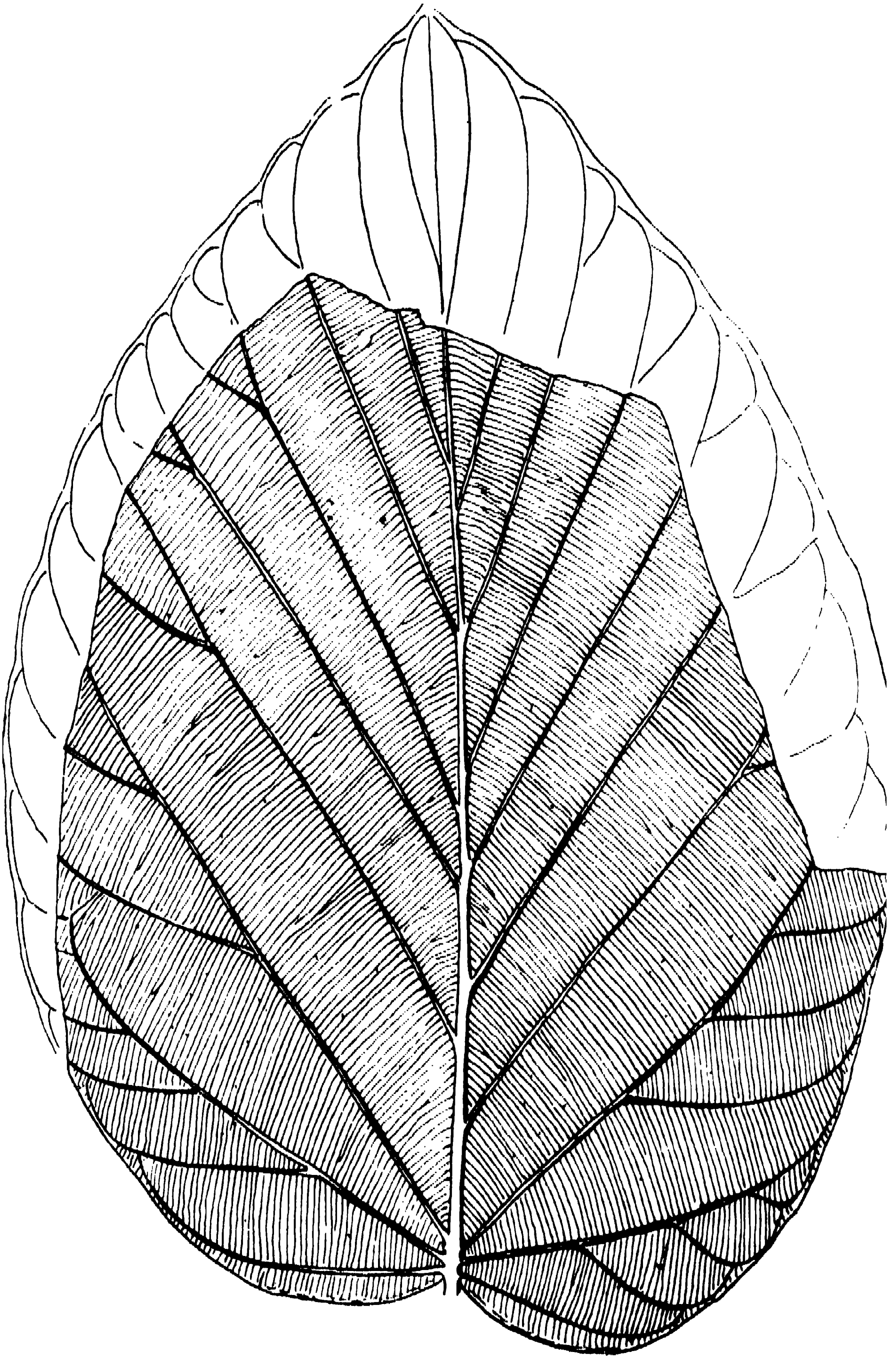
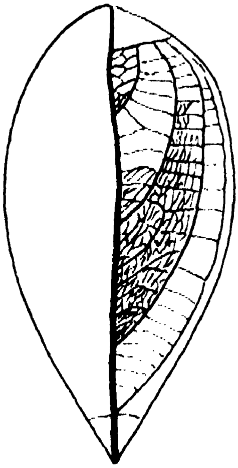
MIOCENE PLANTS FROM SOUTHERN MEXICO.



MIOCENE PLANTS FROM SOUTHERN MEXICO.



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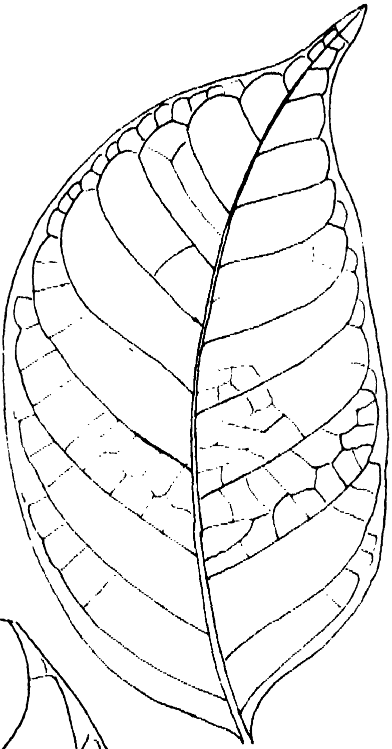

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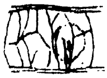

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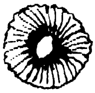

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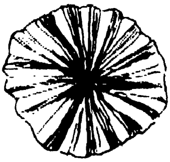

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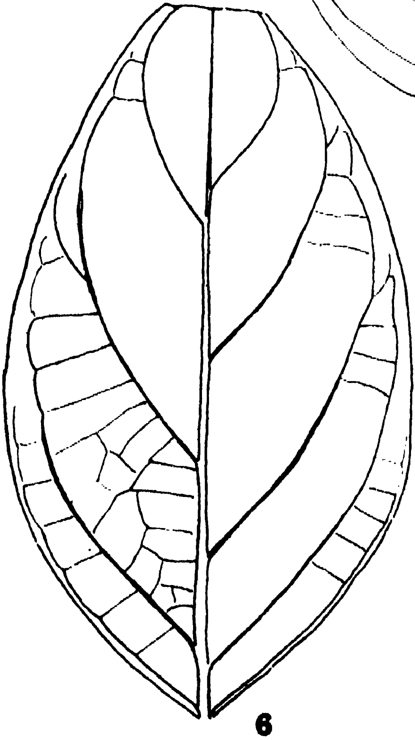

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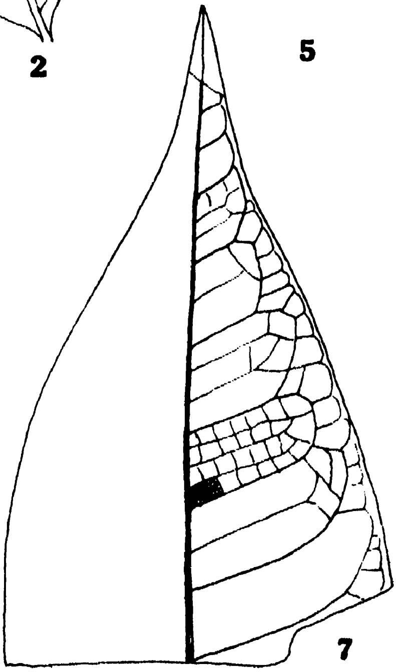

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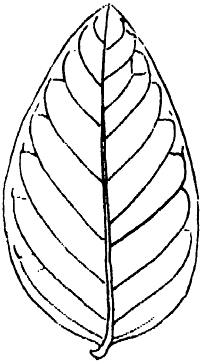
MIOCENE PLANTS FROM SOUTHERN MEXICO.

FOR EXPLANATION OF PLATE SEE PAGE 27



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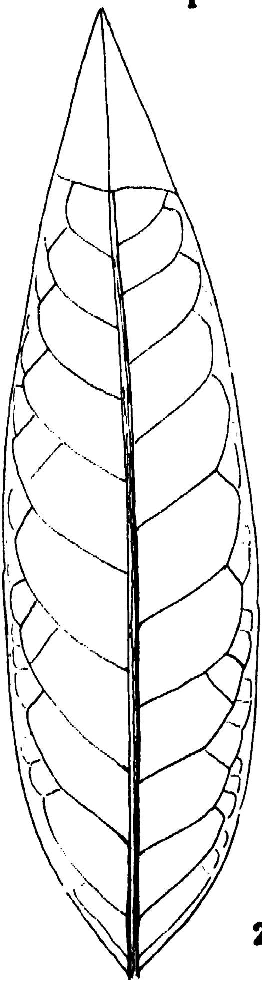

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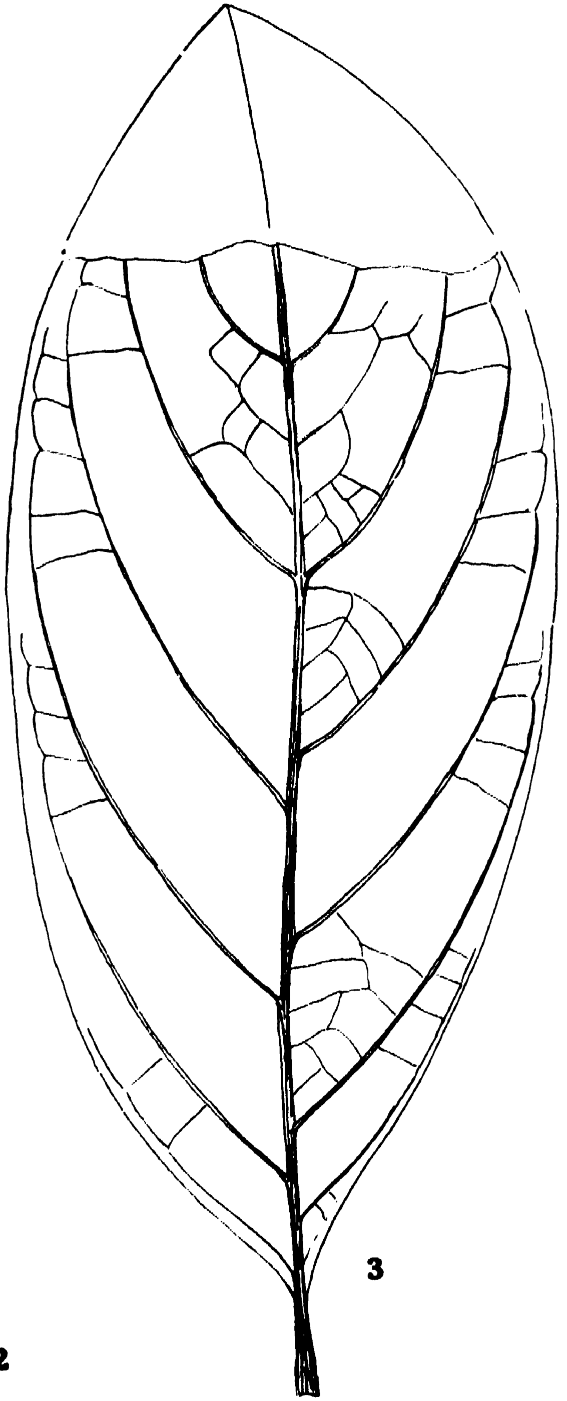

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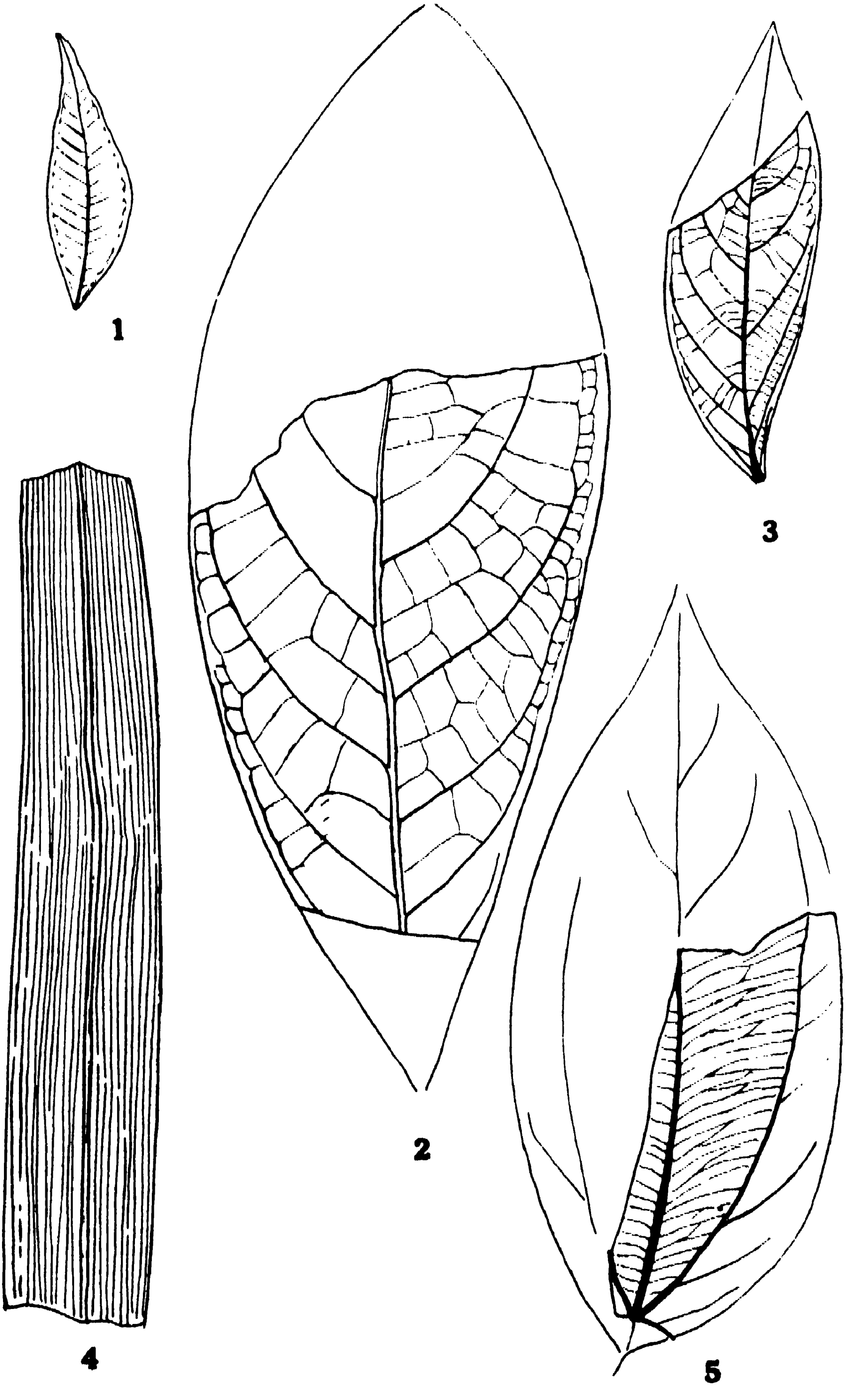
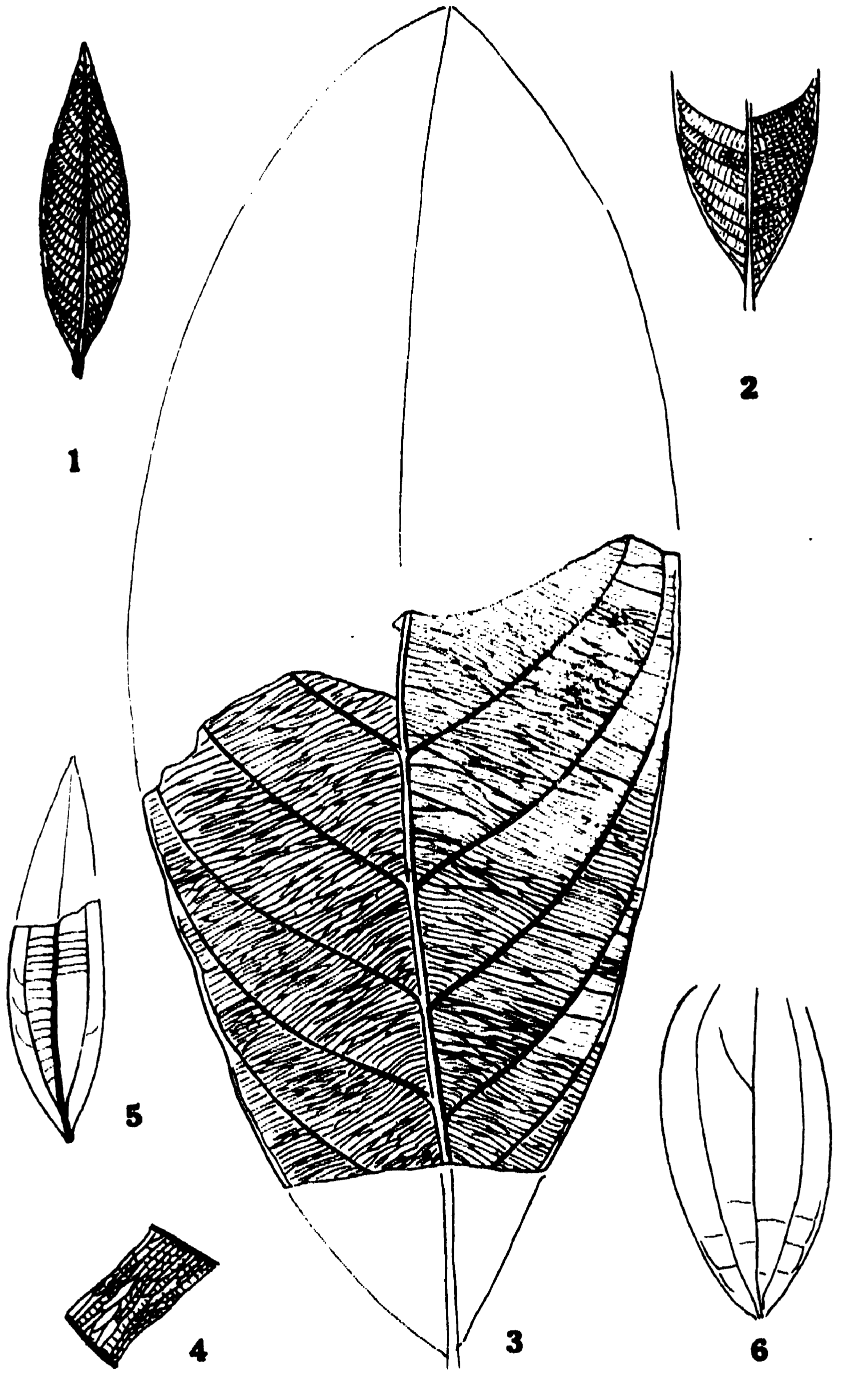
MIOCENE PLANTS FROM SOUTHERN MEXICO.

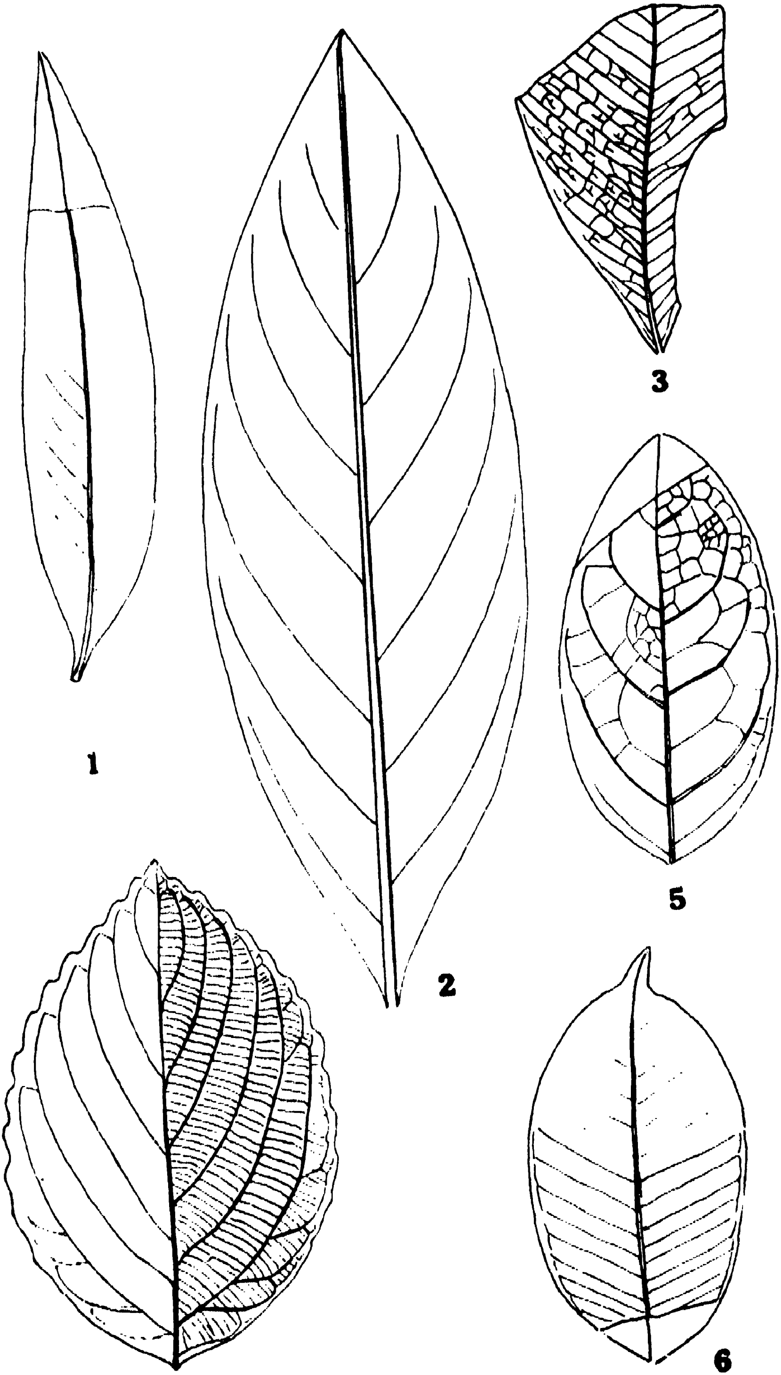


Miocene Plants from Southern Mexico.



MIOCENE PLANTS FROM SOUTHERN MEXICO.

FOR EXPLANATION OF PLATE SEE PAGE 27



MIOCENE PLANTS FROM SOUTHERN MEXICO.

NEW GENERA OF TWO-WINGED FLIES OF THE SUBFAMILY LEPTOGASTRINAE OF THE FAMILY ASILIDAE.

By J. M. Aldrich,

Associate Curator, Division of Insects, United States National Museum.

The present paper is intended primarily to publish a remarkable new genus of fly in which the basal half of the wing is reduced to a slender hairlike stalk. In the study of related forms, however, it appeared that several new genera of the same subfamily are in the United States National Museum collection, and these have also been included, with a table of genera.

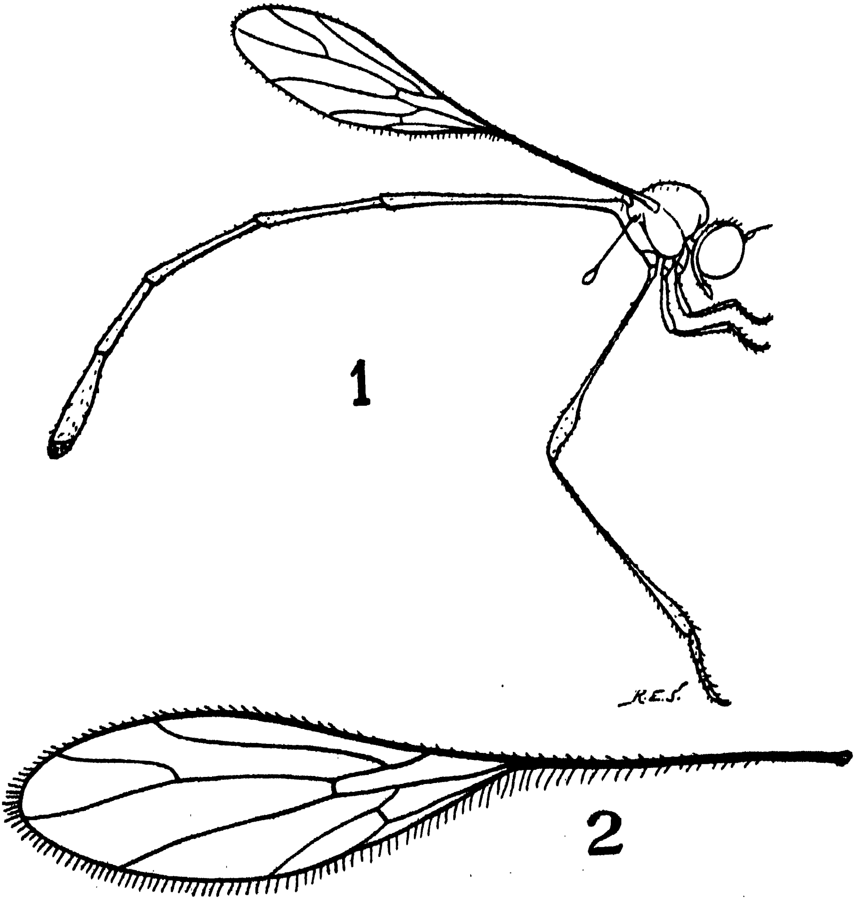
The subfamily Leptogastrinae is readily separated from other Asilidae in America by having the pulvilli absent, the empodia either absent or reduced to a central almost straight claw, about half a long as the other claws; abdomen slender and elongated; marginal cell open, anal angle of wing undeveloped, and cell wide open. In the old world various connecting genera occur without pulvilli. I have included one such American genus, *Caenarolia* Thomson, in the present paper; it is shorter and stouter than the other included forms, and has the anal angle normally developed.

TABLE OF AMERICAN GENERA.

1. Wings uncommonly narrow at base, the seventh vein absent................ 2
   Wings normal, seventh vein present.................................... 3
2. Wing with basal half reduced to a hairlike pedicel, the auxiliary and first veins fused with the costa (Costa Rica)..................*Eurhabdus*, new genus.
   Wing not with slender hairlike basal half, auxiliary and first veins present (Brasil)......................................*Leptopteromyia* Williston.
3. Mesonotum with a pair of erect dorsocentral bristles, anterior to the middle; veins hairy (Costa Rica).................................*Schildia*, new genus.
   Mesonotum without dorsocentrals (with one pair supraalars and one notopleural) 4
4. Antennal style minute, hardly visible; wings longer than abdomen (Brazil) ....*Caenarolia* Thomson.
   Antennal style at least two-thirds as long as third antennal joint............. 5
5. Empodia entirely absent (widespread)......................*Psilonyx*, new genus.
   Empodia present as a median claw about half as long as the other claws (widespread)...*Leptogaster* Meigen.

EURHABDUS, new genus.

Most of the generic characters are well shown in the figure. The wing is greatly reduced in venation. The auxiliary and first longitudinal veins are entirely absent; the third vein originates directly in the costa, which is not especially enlarged; the discal cell is wide open to the margin; the fourth vein is unbranched; there is no seventh vein. The basal portion of the wing for almost exactly one-half of the length is reduced to an exceedingly slender hairlike stalk which has a few delicate cilia on both sides. The antennae are very small and there is a slender subdorsal arista instead of the two-jointed thick style occurring in *Leptogaster*. The head is not greatly flattened, almost as large as the thorax; the latter being somewhat moldy, it is impossible to tell whether it originally had any bristles



Figs. 1-2.—1, Eurhabdus zephyreus, new genus and species, type specimen. Much enlarged. 2, Wing of same, more enlarged. Drawn by R. E. Snodgrass.

or not. The empodia are slightly developed in the form of a middle claw which is about one-third as long as the outer ones.

Genotype.—*Eurhabdus zephyreus*, new species.

EURHABDUS ZEPHYREUS, new species.

Female.—Shining black; the orbits and pleurae with white pollen; the front and middle legs, except the coxae, pale yellow; hind legs yellow except the clubbed apical fourth; hind tibiae yellow; the apical third black and considerably swollen; hind tarsi black; halteres long and slender, yellow, with a shining black knob.

Length, 6.2 mm.

Described from one female collected at Higuito, San Mateo, Costa Rica, by Pablo Schild.

Type.—Female, Cat. No. 25307, U.S.N.M.

In order to bring out as clearly as possible the remarkable reduction which the venation in this species has undergone I have had a figure prepared (fig. 3) of the venation of the type species of *Leptogaster* in which dotted lines are used to indicate the veins which are absent in *Eurhabdus*.

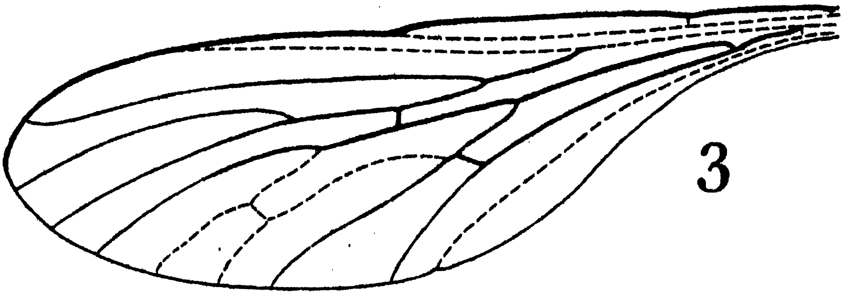


FIG. 3.—WING OF LEPTOGASTER CYLINDRICA. THE VEINS INDICATED BY DOTTED LINES ARE ABSENT IN EURHABDUS. DRAWN BY CHARLES T. GREENE.

Genus LEPTOPTEROMYIA Williston.

Leptopteromyia WILLISTON, Manual of North America Diptera, ed. 3, p. 195, 1908.

This genus exists only by virtue of a named figure in one of Williston's plates. The type species is *L. gracilis Williston*, named, but not described, on the same page, and said to be from Brazil. The head of the specimen is not figured and probably had been broken off. The general appearance is precisely that of *Leptogaster* except that there is apparently no empodium and the wing is much narrower on the basal half. The figure shows a normal discal cell, no seventh vein, first vein present, and probably the auxiliary. The species can in all probability be recognized without difficulty from the figure when rediscovered. The location of the type specimen at the present time is unknown.

SCHILDIA, new genus.

Differs from all the other members of the group in having hairy veins and a pair of dorsocentral bristles near together before the middle of the mesonotum. Venation as in *Leptogaster*, the first vein, however, running parallel with the costa around the curve almost to the extreme apex of the wing.

Genotype.—*Schildia microthorax*, new species.

Named in honor of Pablo Schild, one of the best tropical collectors of small Diptera.

SCHILDIA MICROTHORAX, new species.

Male and female.—Antennae yellow, the third joint brown, not much elongated with subapical slender style which might be called an arista. Head black, proboscis brown. Mesonotum shining, brownish yellow, extending forward with a considerable hump and bearing a distinct median brown stripe which does not reach the scutellum. The characteristic pair of dorsocentral bristles are very evident and in addition there are the two usual pairs, one supraalar, the other notopleural. Pleurae pale yellow above, brown below; the thorax is only a little larger than the head. Halteres elongated and slender, pale yellow with a shining black knob. Abdomen very slender, blackish; the second joint brown with a yellow ring in the middle; second segment of the abdomen as long as the wing to the fork of the third vein or a little longer. In the male this is much less than one-half the entire length of the abdomen; in the female, however, it is a little more than one-half the entire length. Front and middle legs and all the coxae yellow; hind legs brownish-yellow with a blackish tip preceded with a yellow ring which is on the beginning of the swollen portion; hind tibae brownish-black; hind tarsi brown. All the tarsi in both sexes are destitute of empodia and have the outer claw twice as long as the inner one. Wings hyaline, glabrous except the veins, which are distinctly hairy. The costa is ciliated from near the base to the apex with noticeably fine and dense hairs; the outer vein curves backward so as to end almost exactly in the apex of the wing. The male genitalia are very small, the visible portion consisting of a pair of small curved brown processes projecting directly backward.

Length of male, 8.4 mm., of female, 5.9 mm.

Described from one male and one female collected at Higuito, San Mateo, Costa Rica, by Pablo Schild.

Type.—Male, and allotype, female, Cat. No. 25308, U.S.N.M.

PSILONYX, new genus.

Differs from *Leptogaster* only in the complete absence of empodia.
Genotype.—*Leptogaster annulatus* Say.

PSILONYX ANNULATUS Say.

Leptogaster annulatus SAY, Journ. Acad. of Nat. Sci., vol. 3, p. 75, 1823; Complete Works, vol. 2, p. 68.—BACK, Trans. Amer. Ent. Soc., vol. 35, p. 159, 1909.

In making this species the type of a new genus I am carrying out, after the lapse of a century, a suggestion made by Say in his original publication, as follows:

> The nervures of the wings of this insect, do not perfectly correspond with those of *L. tipuloides*, which circumstance, combined with another highly important difference that this insect exhibits, in having but two nails to the tarsi, would justify the generic separation of the *annulatus* from the *tipuloides*, and its reference to a distinct genus.

Specimens in the writer's collection from Ecuador do not seem to be distinct from others collected at Lafayette, Indiana. There are, however, some additional tropical species which can not at present be elucidated; and Mr. Back has described a second species from the United States, *P. schaefferi* from Brownsville, Texas.

Genus LEPTOGASTER Meigen.

Leptogaster MEIGEN, Illiger's Magazin, vol. 2, p. 269, 1803; Systematische Beschreib., vol. 2, p. 258, 1820.
Gonypes LATREILLE, Histoire nat. Crust. et Ins., vol. 14, p. 309, 1804.
Leptogaster BACK, Trans. Amer. Ent. Soc., vol. 35, p. 155, 1909.
Tipulogaster COCKERELL, The Entomologist, vol. 46, p. 213, 1913.

In the original description Meigen mentioned only *Asilus tipuloides* Fabricius, which is now regarded as a synonym of *Asilus cylindricus* DeGeer. The type of *Gonypes* is also *tipuloides*. The type of *Tipulogaster* is *badius* Loew.

There are many species of this genus, which appears to be widespread in the Eastern and Western Hemispheres, both in tropical and temperate regions.

Genus CAENAROLIA Thomson.

Caenarolia THOMSON, Kongliga Svenska Fregatten *Eugenies* Resa Omkring Jorden, vol. 2, Zoology No. 1, p. 470, 1868.
Acronyches WILLISTON, Manual of North American Diptera, ed. 3, p. 388, 1908.

Thomson described this genus from a single new species which he called *longipennis*. It was from Rio Janeiro. He refers to *miles* Wiedemann as belonging to the same genus, but gives no description of it.[1] Wiedemann's description of *miles* is so brief that it is evident that Thomson must have seen the type or he could not have assigned it to this genus. Williston figures a species which appears to agree exactly with *longipennis* except that the fourth posterior cell is open while it is closed before the margin in Thomson's species. He mentioned this genus in this connection because it has no empodia and has many characters in common with *Leptogaster*. However, the normal development of the anal angle of the wing and especially the form of the analcell, which is almost closed in the margin, indicates a considerable divergence from the *Leptogaster* type.

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[1] *Dasypogon miles* Wiedemann, Aussereuropäische Zweiflügelige Insekten, vol. 1, p. 393, 1828, from Brasil.

THE DRAGONFLIES (ODONATA) OF BURMA AND LOWER SIAM—III.[1] SUBFAMILY AESCHNINAE.

By Frank Fortescue Laidlaw,
Of Uffculme, England.

INTRODUCTION.

The preceding paper of this series was published so long ago as 1907. Following Mr. E. B. Williamson's kind suggestion, I propose to attempt to carry on in this and in subsequent parts the faunistic survey commenced by himself. In the first place I must express my regret that he should be unable to complete the work so admirably begun, and my appreciation of my own inadequacy to continue the series at the high level at which it started. I shall endeavor to follow the general plan of his two papers, and I have to thank him and likewise the authorities of the United States National Museum for the opportunity of dealing with the large and important collections on which this account is based.

The material available consists of: 1, Several thousands of specimens collected by Mr. R. A. Earnshaw in the Karenni and Toungu districts of Burma, the property of Mr. Williamson; 2, the collection made by Dr. W. L. Abbott in lower Siam, presented by him to the United States National Museum.

These rich stores have been supplemented by other smaller collections, the property of Mr. Williamson. These are, 1, a small collection from Candelay, Ceylon; 2, material from central India (Mhow), the northwest Provinces (Lucknow and Meerut), Burma (Rangoon), collected by Brunetti; 3, a few specimens from Penang; 4, a small collection from various localities in Annam and Tonkin; and lastly 5, three specimens from the southern part of the Celebes.

I am able to supplement the information obtainable from these sources by the fact that I have had access to the collections of the Calcutta Museum, to those of the Sarawak Museum, and to collections

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[1] The first and second parts of the series, both by Mr. E. B. Williamson, are as follows:
The Dragonflies (Odonata) of Burma and Lower Siam.
I. Subfamily Calopteryginae, Proc. U. S. Nat. Mus., vol. 28, pp. 165–187, published Apr. 22 1905.
II. Subfamilies Cordulegasterinae, Chlorogomphinae, and Gomphinae, Proc. U. S. Nat. Mus., vol. 33, pp. 267–317, published Dec. 13, 1907.

No. 2467.—Proceedings U. S. National Museum, Vol. 62, Art. 21.

made partly by myself, from the Malay Peninsula. With these last collections I have dealt or am dealing, in papers referred to where necessary in the sequel.

Mr. Williamson did not confine his survey entirely to Burma and lower Siam in dealing with the Calopteryginae and Gomphinae, but increased the value of his notes by including in them remarks on other oriental species; in this I hope to follow him. But though it is evident that I have at my disposal for study a very considerable amount of material, it will be evident equally that very much remains to be done before it becomes possible to assume that our knowledge of the occurrence and distribution of species constituting the oriental dragonfly fauna is in any degree exact.

A word as to the extension of this fauna will not be out of place. I regard it as occupying the following areas: The whole of British India, including Ceylon, but excluding Kashmir and Baluchistan; China south of the Yang-tze-Kiang; the whole of Indo-China; the Malay Peninsula and the Malay Islands as far as Flores; the Philippine Islands, the Celebes; Hainan, Formosa, and South Japan. In Flores and in the Celebes the oriental fauna meets and mingles with the Papuan; in China and South Japan with the Palaearctic.

NOTES ON RELATIONSHIP OF GENERA.

The present part deals with a subfamily, the Aeschninae, remarkable for the large size and superb powers of flight of many of its members. The group is a dominant one, and like most dominant groups it presents special difficulties to the systematist.

The arrangement of genera here employed is largely identical with that elaborated by Walker (1912) in his Monograph of the North American Species of the genus Aeschna. His table of genera is probably the best that can be constructed on our present acquaintance with the group, and any departures made therefrom in this paper are due to differences of opinion on matters of small importance.

But the table can not be regarded as a satisfactory phylogenetic system. For this we must wait for the accumulation of much knowledge, morphological, developmental, palaeontological that is not now in our possession; and the present arrangement of the genera must be taken as a grouping according to the level of development to which they have severally attained; mainly in respect to the specialization of venation, rather than as an indication of lines of descent.

As exemplifying the difficulties which beset the study of the phylogeny of the subfamily I instance here the "dentigerous plate" of the female.

This structure, a specialization of the sternite of the tenth abdominal segment of the female, is characteristic of the Aeschinae, and is not paralleled in any other Odonates. The specialization enables the sternite to be used as accessory organ of oviposition, called for convenience the "dentigerous plate." It is found in a relatively undifferentiated and presumably primitive condition in such genera as *Anax* and *Aeschna*, and attains its highest development in *Gynacantha* where it has become a remarkable forklike structure, the two prongs of the fork having a length in most species of somewhere about 1 mm. Now, *Periaeschna*, a genus belonging to the Brachytron series, has its dentigerous plate almost identical with that of *Gynacantha;* not, it is true, quite so highly developed but still showing an identical plan. And further, in *Cephalaeschna*, also a member of the Brachytron series, we find a still less developed type of the same structure, again designed on the same ground plan.

So, were we to use this character as our sole criterion of relationship, we should be justified in regarding the three genera *Celphalaeschna*, *Periaeschna*, and *Gynacantha*, as representing stages of specialization along a single line of descent; and we could reasonably argue that *Gynacantha* had arisen from a different stock to that which has given rise to *Aeschna* and *Anax* and to their more immediate allies.

But this would of course imply that *Gynacantha* on the one hand, and *Aeschna* (and *Anax*) on the other, had developed independently an almost identical system of venation. In any case we are confronted with a dilemma from which I can see no way of escape.

Either *Periaeschna* and *Gynacantha* have developed independently an almost identical dentigerous plate, or *Gynacantha* and *Aeschna* have evolved an almost identical system of venation by convergence.

It is evident that some other character or combination of characters must be utilized to provide sufficient evidence. Such may be found ultimately in the genital structures of the male, in larval characters, or elsewhere. The necessary material, time, and knowledge are, I regret, not available for me.

EXPLANATION.

In the following account of the oriental genera I employ the Comstock-Needham nomenclature for the venation. Mr. Williamson's diagrammatic figure of the wing of a dragonfly of the family Aeschnidae published in the second paper of this series (p. 270, figs. 1–3) is a sufficient guide to the terms employed in the present account.

It will be noticed that the number of specimens of Aeschnines in the collections before me is remarkably small, when compared with the great numbers of Libellulinae and Coenagrioninae. Further no examples of the Brachytron group are included, so I am compelled to deal in a very general fashion with those genera, and to make my account of the subfamily a sketch of the oriental members thereof, rather than a full or critical account of the species. regret, I this especially because it is evident that the genera of the Brachytron series requires careful revision, as does the synonymy of some of the species.

DISTRIBUTION.

The accompanying diagram will, I hope, serve to show at a glance the distribution of some of the more characteristic forms. If it be compared with a map showing the average yearly rainfall it will at once be evident that many of the genera seem to be especially dependent on a very copious rainfall for their existence. With this is perhaps to be correlated an observation I made whilst in the Malay Peninsula; that some of these insects seem to select for breeding purposes quite small pools, one might almost call them puddles, which are only kept supplied with water by rain. Nor are dragonflies by any means the only creatures which lay their eggs in such exiguous nurseries. I remember more than once finding frog-spawn in depressions little larger than a foot print, hopelessly dessicated with a few hours of sunshine.

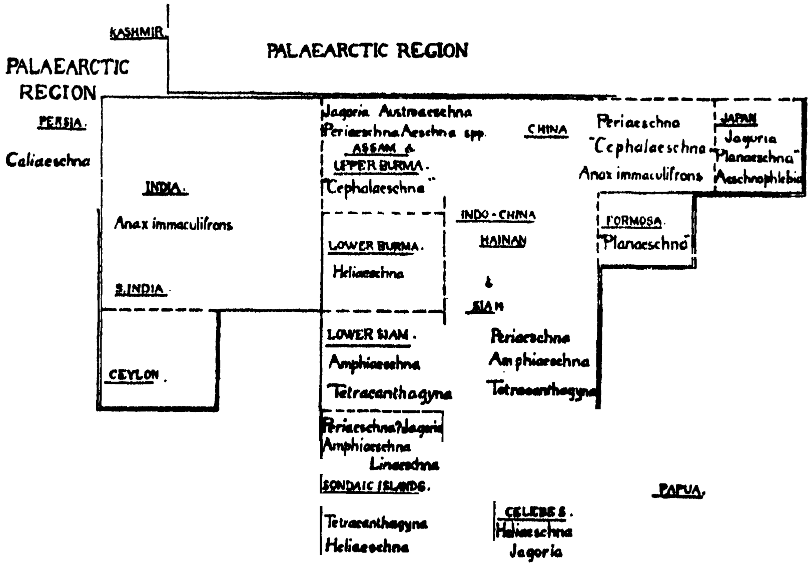

FIG. 1.—IN THE ABOVE DIAGRAM THE BOUNDARIES OF A REGION ARE MARKED BY A DOUBLE LINE. THE DEGREE OF DIFFERENTIATION BETWEEN AREAS WITHIN THE REGION IS INDICATED BY A SINGLE LINE OR BY A DOTTED LINE, ACCORDING TO THE CLEARNESS OF DISTINCTION OR OTHERWISE. SIMILARLY, THE BOUNDARIES OF THE REGION, WHERE THESE ARE NOT CLEARLY DEFINED, ARE MARKED BY A SINGLE LINE OR BY A DOTTED LINE. ONLY THE MOST CHARACTERISTIC GENERA ARE ENTERED.

CHARACTERIZATION OF THE SUBFAMILY AESCHNINAE.

Triangles of fore and hinder wing approximately equal, longitudinally elongated; subtriangles weak or absent. Radial and median supplements present. Two reinforced antenodal costal cross-nerves.

Eyes usually in contact mid-dorsally for a long distance. Labium with median lobe slightly incised, or with a longitudinal depression. Female with complete ovipositor.

Larva with elongated abdomen; mask flat, without setae (except in *Gynacantha*); lateral lobes narrow with apex of variable form; long movable hook.

Gizzard with four radially symmetrical fields carrying a few large, specialized teeth. Respiration effected by rectal gills of the duplex form. (Tillyard).

KEY TO THE ORIENTAL GENERA OF THE SUBFAMILY AESCHNINAE.

1. Radial supplement straight, separated from radial sector or its lower branch by a single row (usually) of cells only. Median supplement similarly placed with regard to M_4. (Larva with processus dorsalis usually pointed, not bifid at the apex)..BRACHYTRON (group) 2

Radial supplement curved concavely to radial sector, with three or more rows of cells between. Median supplement similiarly arranged with respect to M_4. Radial sector unforked, or unsymmetrically forked. (Larvae with processus dorsalis bifid at apex)..................................(AESCHNA group) 6

2. Radial sector not forked, M_2 with marked convexity anteriorly, just proximal to pterostigma. Lower appendage strongly bifid..........................3

Radial sector symmetrically forked; its branches nearly straight. (BRACHYTRON series) 4

3. Venation open. Space between median supplement and M_4 with maximum breadth of two cells below the nodus for a length of two cells only....**Jagoria.**

Venation dense. Space between median supplement and M_4 with two rows of cells, from before level of nodus to end of wing.................**Linaeschna.**

4. Median space without cross nerves...............**Austroaeschna-Planaeschna.**

Median space with cross nerves...5

5. Dentigerous plate of female simple or armed with two short spines **"Cephalaeschna"** (**Caliaeschna**).

Dentigerous plate of female armed with a pair of long decurved spines **Periaeschna.**

6. Cells between Rs and Rspl arranged in very regular oblique rows. Anal angle of male hinder wing rounded, Rs unforked. M_2 with marked convexity forward under the pterostigma. Accessory longitudinal carinae on segments 3–8 of abdomen. Dentigerous plate simple .... (ANAX series) **Anax.**

Cells between Rs and Rspl irregularly arranged. Anal angle of male hinder wing pronounced. Rs forked usually distal to pterostigma. Dentigerous plate of female simple or armed with four or more spines. Diurnal forms. (AESCHNA series) 7

Cells between Rs and Rspl irregularly arranged. Rs forked proximal to pterostigma. Anal angle of male pronounced.

Crepuscular forms. Dentigerous plate or female armed with a pair of long decurved spines .... (GYNACANTHA series) **Gynacantha.**

7. M_2 with convexity forward below pterostigma. Abdomen with traces of accessory lateral carinae on segments 4–7.............................. **Anaciaeschna.**

M_2 without marked convexity forward. Abdomen without accessory lateral carinae 8

8. Dentigerous plate of female simple, armed only with small spines, usually not regularly arranged.. 9

Dentigerous plate of female with four or more large spines, the median pair being larger than the others. Wings rather sharply pointed.....................10

9. **Median space with cross nerves. Arculus much angled.........** **Amphiaeschna.**
Median space without cross nerves....................................... **Aeschna.**
10. **Median space with cross nerves. Size moderate.................** **Heliaeschna.**
Median space free. Size very large......................... **Tetracanthagyna.**

These genera may be grouped as follows:

BRACHYTRON GROUP.		AESCHNA GROUP.	
	Jagoria.	*Anax* series:	*Anax.*
	Linaeschna.		*Anaciaeschna.*
Brachytron series..	*Caliaeschna ?*		*Amphiaeschna.*
	Cephalaeschna.	*Aeschna* series.	*Aeschna.*
	Periaeschna.		*Heliaeschna.*
	Planaeschna ?		*Tetracanthagyna.*
	Austroaeschna.	*Gynacantha* series:	*Gynacantha.*

I do not use the term *Boyeria* series for *Jagoria* and *Linaeschna*, because it seems to me that such a series does not exist, i. e., that the various genera with unforked radial sector and straight supplements can not all be referred to a single series. On the other hand I think a good case can be made out for a Brachytron series, as it would appear that all the genera here referred to that series and others that are nonregional are closely related to the typical genus Brachytron.

The suppression of the genus *Hemianax* is dependent on the amount of importance one attaches to the characters which separate *Hemianax ephippiger* from the species of *Anax*. Personally I think them of not more than specific value.

The inclusion of *Anaciaeschna* in the *Aeschna* series rather than with *Anax* is again a matter of opinion and of convenience. The genus is decidedly annectant.

Lastly in transferring *Heliaeschna* and *Tetracanthagyna* from the Gynacantha series to the Aeschna series I have been guided largely by the extreme differentiation in the genus *Gynacantha* of the dentigerous plate. That of *Heliaeschna,* so far as I know it, and of *Tetracanthagyna* seems to me to stand nearer to *Aeschna.* There is of course nothing decisive in the venation.

NOTES ON LARVAE.

The characterization of the main groups in the above table is largely drawn from Tillyard's Biology of Dragonflies.[1] Since writing it and the preceding part of this paper I have been able to secure some additional imformation on one or two points of interest. This had been derived in part from an examination of larvae of two species of *Cephalaeschna* (?) from the Himalaya, identified by examination of the venation, and from larvae of *Aeschna ornithocephala* MacLachlan from the same part of the world.

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[1] The Biology of Dragonflies. Cambridge University Press, 1917, Cambridge, Eng.

The first two species are quite distinct from each other, both belong undoubtedly to the Brachytron series, and they are probably not congeneric. For convenience sake only I refer both to *Cephalaeschna*.

One of these "*Cephalaeschna*," which is represented by some 4 specimens, all probably in the last or penultimate instar, has the appendix dorsalis very definitely bifid, ending in a pair of pointed processes, whilst in the other species, of which I have also several examples, the same structure is simple.

I was fortunate enough to be able to mount a wing of the former species which showed very clearly the details of the tracheation. A very interesting point distinctly shown in this specimen is that the fork of Rs is not preceded by a fork in its tracheal precursor.

The trachea, however, give off on its anal side several (four or five) small but well-marked branches, which run to the anal margin of the wing. From each of these a fine twig is given off nearly at right angles to it; these twigs together form a line of delicate tracheation running parallel to the main trunk of Rs, and along their course the chitinous supplement (Rspl) is laid down. A precisely similar condition obtains with regard to M_4 and its supplement in this wing.

In the case of the larva of the second species of "*Cephalaeschna*" I have not been able to make out anything of the tracheation.

Turning now to the larva of *Aeschna ornithocephala*, a specimen in the last instar fortunately showed the tracheation with beautiful clearness. I was surprised to find in this specimen that both M_4 and Rs each give off a strong branch, practically a fork near the level of the beginning of their respective supplements, and that this fork follows the course taken by the supplement in either case; giving off in addition three or four branches to the hinder margin of the wing, whilst the anterior branch of the fork after running toward the apex of the wing turns analward at the level of the small imaginal "fork" without giving off any branch of importance. So that in this form, and presumably in other *Aeschnas* the median and radial "supplements" should be termed rather the median and radial branches. Tillyard's figure (p. 44, fig. 17-A–B) of the tracheation of *Aeschna brevistyla* in the Biology of Dragonflies shows the forking of M_4 but he does not figure enough of the wing to show the fork of Rs.

Lastly, in *Anax* the tracheation has been in part figured by Needham in his Genealogic Study. He shows there in a beautiful microphotograph of the larval wing of *Anax junius* Drury, that the median supplement is formed as in "*Cephalaeschna*" species along a line of secondary tracheal twigs derived from branches of M_4; and the radial supplement is formed in a similar manner, as I have been able to satisfy myself by an examination of larva of *Anax ephippiger*.

These observations explain the presence of an oblique vein near the commencement of the radial supplement in *Aeschna* (and presumably in *Gynacantha* and in other genera), this oblique vein following the lower branch of the fork of tracheal Rs. And similarly in the case of the median supplement.

They also explain why it is that in *Anax* there are several oblique veins in the area between Rs and Rspl, these veins representing the several regularly arranged branches of tracheal Rs (or again of M_4).

But whether *Aeschna* or *Anax* shows the more primitive arrangement of the tracheae I can not determine. In this connection Needham's remarks in his Genealogic Study deserve careful consideration.

Genus JAGORIA Karsch.

Up to the present unrecorded from Burma or Siam. Species are known from Sumatra, Borneo, the Malay Peninsula, the Philippine Islands, the Celebes, and from Japan; whilst an unpublished form occurs also near Darjiling, represented in the collection of the Indian Museum by a female specimen taken at an altitude of 2,140 meters (7,000 feet).

Jagoria seems to have as its nearest ally the American *Gomphaeschna*. *Linaeschna* from Borneo, with these two genera forms a small group of forms of a primitive appearance, which stand rather far apart from other genera of the Brachytron series.

The genus is remarkable for the strongly bifid interior anal appendage of the male, a feature shared by *Gomphaeschna* and *Linaeschna* and otherwise found amongst *Aeschninae* only in the primitive *Petalia* alliance. Another interesting character is that afforded by the lateral dilatation of the abdomen of the female, which, beginning at the distal end of the third segment, reaches its maximum at the fifth and disappears at the apex of the sixth segment, giving the abdomen a curious quasi-archaic appearance.

JAGORIA POECILOPTERA Karsch.

The type of the genus is *Jagoria poeciloptera* Karsch, from Luzon. (The male recorded under this name by Karsch from Singapore is probably rather an example of the next species *Jagoria modigliani*.) This is a species of small size; Martin notes the length of the hinder wing as being 45–37 mm. The pterostigma is said by the same writer to be short and narrow, and the wings of the female are marked with bright saffron color at their bases.

JAGONIA MODIGLIANI de Selys.

Jagonia modigliani de Selys, the best known species occurs in the Malay Peninsula, Borneo, and Sumatra. It is larger than the preceding; a female before me has the hinder wings 43 mm. in length, the pterostigma is 3.75 mm. and of a reddish-brown color. The whole wing except the median space and the anal area is tinged with bright orange-brown; a teneral female, however, has the wing apices colorless. The male is said to have the wings uniformly of a yellow hue. The supratriangular space is crossed by a single nerve. Ris regards Needham's *Dolaeschna elacatura* as synonymous with the present species.

JAGORIA VENATRIX Foerster and JAGORIA BÜHRI Foerster.

Two other species have been described by Foerster; *venatrix* from Buton, an island of the Celebes group, of about the same size as *modigliani*. The male only is known; and *bühri* from north Borneo closely allied to *poeciloptera*, but a trifle larger. The pterostigma is said to have a length of 2.5 mm., and the wings of the female to be entirely bright brown. Both species are unknown to me.

JAGORIA PRYERI Martin.

Jagoria pryeri Martin, from Japan, has the supratriangular spaces uncrossed, the hinder wing of the male is 38 mm. long, and the pterostigma 3.5 mm. and the wings are described as being yellowish. The inferior anal appendage of the male, the only sex known, is relatively shorter and broader than in other species of the genus.

JAGORIA, species.[1]

Lastly, the female specimen from Darjiling has the supratriangular spaces uncrossed and the wings colorless. The length of the hinder wing is 38 mm. and of the pterostigma 3 mm.

Genus LINAESCHNA Martin.

The Bornean genus *Linaeschna*, known from a single male specimen described and figured by Martin is, I think, certainly a close ally of *Jagoria*, though whether it is to be regarded as more primitive or more specialized I am quite unable to say.

Genus AUSTROAESCHNA de Selys.

Otherwise confined to Australia this genus is represented by a species from Assam. I can not find any character of importance sufficient to separate it generically from the Australian species. This interesting creature, known as *Austroaeschna intersedens* Martin, belongs to a small group of Himalayan species which seem to have relationship to Australian forms rather than to nearer neighbors. Such are *Lestes cyanea* de Selys and *Argiolestes melanothorax* de Selys. Another Aeschnine *Planaeschna milnei* (de Selys) from Formosa and Japan is regarded by Martin as an *Austroaeschna;* I have not seen an example, but venationally it certainly comes very near *intersedens*, and may well be congeneric with it. But for the present I think with Ris that the genus *Planaeschna* may be retained, pending a critical revision of the *Brachytron* series as a whole.

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[1] Now published as *Jagoria martini* Laidlaw (Laidlaw, Rec. Ind. Mus., vol. 22, pt. 2, pp. 76–77).

Genus CEPHALAESCHNA de Selys.

Plate 1, fig. 1.

For lack of material and sufficiently full information it is a matter of impossibility to deal in a satisfactory manner with the species grouped as a matter of convenience in this genus. In his monograph Martin adopted the course of suppressing the genus altogether, and referred a number of species to the Palaearctic genus *Caliaeschna* de Selys. He had been anticipated in this to a certain degree by Foerster who in 1908 described a Malayan species, belonging to the Brachytron series as *Caliaeschna laidlawi*. I prefer to regard *Caliaeschna* as a monotypic genus probably confined to Asia Minor, Persia, and neighboring countries, and to leave some at least of the other oriental members of the series in the Selysian genus.

But I admit this is merely the expression of an opinion which has not much substantial backing behind it and I believe that it is very likely that those members of the series here referred to *Cephalaeschna* may in future be found to stand in two or possibly even more genera.

The genus *Cephalaeschna* was defined by de Selys (1883) in his Synopsis, and accepted by Karsch (1891) in the Kritik. Karsch moreover added a second species to the genus, *Cephalaeschna sikkima*, the type being *Cephalaeschna orbifrons* de Selys.

C. orbifrons has a simple dentigerous plate in the female; that of *sikkima* is said to be armed with a pair of pointed spinelike processes. In this respect *acutifrons* Martin resembles *orbifrons*. I have before me the female of an undetermined species (probably = *Caliaeschna lugubris* Martin ? = *Caliaeschna sikkima* Karsch) in which the dentigerous plate of the female is like that of *sikkima*.

Foerster's species *laidlawi*, seems to me from his description to belong rather to the next genus *Periaeschna*. Of *masoni* Martin, the female is unknown.

There is evidently considerable difference in the venation of these species. That of *acutifrons* is very dense, that of the female before me comparatively open; both have the pterestigma braced.

Cephalaeschna conspersa Tillyard has lately been assigned to a distinct genus *Dendroaeschna*, by its author.

In reviewing the genus *Cephalaeschna* I have been influenced largely by the fact that de Selys regarded its type species as generically distinct from *Caliaeschna*. The latter has an unbraced pterostigma, the interorbital suture is relatively short, and the triangles especially of the hinder wings relatively very small. Due weight should, I think, be also given to the very different characters of the areas occupied by the two genera, the arid or at least droughty regions ranging from the Balkan Peninsula to Persia on the one hand, and the damp densely forested countries to the north and east of the Bay of Bengal on the other.

It is to be hoped that sooner or later an ample supply of material will enable some one to unravel the tangle in which these very interesting insects lie. For the present I refer to *Cephalaeschna* but only provisionally the following species: *acutifrons* Martin, *masoni* Martin, *sikkima* Karsch,[4] *lugubris* Martin, and of course without condition *orbifrons* de Selys, all from the northeast Himalayas. *C. acutifrons* occurs also in Kwan-Tung.

LIST OF ORIENTAL SPECIES OF THE GENUS CEPHALAESCHNA.

1. *C. orbifrons* de Selys: Northeast Himalayas.
2. *C. sikkima* Karsch:[4] Northeast Himalayas.
3. *C. acutifrons* Martin: Northeast Himalayas, Kwan-Tung.
4. *C. masoni* Martin: Northeast Himalayas.
5. *C. lugubris* Martin: Northeast Himalayas.

Genus PERIAESCHNA Martin.

Plate 1, fig. 2.

The single described species of the genus *Periaeschna magdalena* Martin is from Tonkin. The Indian Museum collection includes a pair apparently of the same species from the Garo Hills in Assam; and Ris tells me in a letter that he has a species of the genus, not necessarily conspecific, from Yunnan. For reasons given above I think that *Caliaeschna laidlawi* will probably be found also to belong to this genus.

In addition to the specialization of the dentigerous plate, *Periaeschna magdalena* has densely veined wings, and a small pterostigma with well developed brace. The male has the second abdominal segment rather inflated and the base of the third much narrowed. Its anal appendages are much like those of *Aeschna mixta* Latreille.

Genus ANAX Leach.

The Palaearctic species *Anax parthenope* de Selys has established itself in India as far south as Mysore in the peninsula. Several other species are found within the limits of the region. All of them frequent open sunny country and it is noteworthy that *ephippiger* Burmeister does not appear to have been recorded for any of the more densely forested areas, or equatorial territory, whilst it is exceedingly abundant in most parts of India, one observer saying that he has never seen such numbers of any other dragon fly in flight. This species, interesting as being partly migratory in its habits has also

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[4] Since these notes were sent to press the genus *Gynacanthaeschna* has been erected for this species by Fraser (Journ. Bombay Nat. Hist. Soc., vol. 28, June 1922, p. 618). The other species in my list are retained in *Cephalaeschna*.

a wide range over the Mediterranean countries. It has been usually referred to a genus *Hemianax* de Selys distinct from *Anax*, as it lacks the supplementary carinae on segments 4–8 of the abdomen found usually in *Anax*, and it has also a triangular lower anal appendage in the male, whilst other species of the genus have that appendage squarely truncate.

These characters are, I think, of not more than subgeneric value and I follow Tillyard in allotting the species to the main genus.

A second species is the beautifully colored *immaculifrons* Rambur which has been taken as far west as Damascus, and of which a geographical race is recorded for Hongkong by Ris. I have not been able to find any record of its capture in the Indo-Chinese Peninsula, or in the equatorial areas of the region.

The remaining oriental species of the genus are decidedly difficult to differentitate clearly, and their synonymy is obscure. The arrangement given below has been arrived at from a study of Ris's papers quoted in the sequel (Ris 1913, 1913*a*), and partly from his opinions given me in correspondence on the subject, as well as from examination of material available to me. As Ris has written me, it will at least serve as a working arrangement for the present.

ANAX GUTTATUS Rambur.

Without T-mark on frons. Thorax without black lines on sutures. Markings on abdominal segments 3–10 consist of yellowish brown spots, of which there are three on either side of the dorsum of segments 3–6. Length of abdomen of male about 55 mm., of which the third segment occupies from 8.5 to 9.5 mm. Upper anal appendages 6 mm. additional. Hinder wing 52 mm. long, pterostigma 5 mm. Range extensive, from the Seychelle Islands in the west to Samoa in the east.

I have seen specimens from India, Ceylon, the Malay Peninsula, and Borneo.

Doctor Ris remarks in a letter that the species appears to be well defined, and its characters constant.

ANAX GIBBOSULUS

With a dark border to the anterior margin of the frons, connected by a bar of variable width to the black mark at the base of the frons. Markings on segments 3–9 of abdomen consists of small apical-lateral pale spots; in addition segments 3–5 have each a small basal lateral spot on either side.

Length of abdomen of male about 62 mm., the third abdominal segment is about 11.5 mm. long and is relatively more slender than in *A. guttatus*. The anal appendages are 6.5 mm. in length, and the hinder wing and pterostigma measurements are about 55 and 5 mm., respectively.

The precise range of the species is undetermined; it is chiefly found in the Moluccas and Papua. I have not been able to examine specimens; but Ris regards it as a monomorphic species.

Synonym.—*Anax panybeus* Hagen.

ANAX FUMOSUS Hagen.

With well-defined T-mark on frons. Thorax with black lines on the sutures. Coloring of abdomen richer than in the two preceding species, bluish-green spots on a black ground. Markings on segments 3–7 consist of paired apical and basal spots on each segment; on segments 4–6 the basal spots are transversely divided by a narrow black line into two.

Length of abdomen of male 48 mm., upper anal appendages, black in color, 6.2 mm. Third segment of abdomen 9 mm. long. Hinder wing and pterostigma 0.48 and 4 mm. in length, respectively.

I have seen specimens from the Himalayas (Coll. Indian Museum) and Japan (Brit. Mus.). The typical race is from Ternate. Doctor Ris tells me he possesses examples presumably of a form of this species from Java. He believes it to be a variable species probably with local races. The measurements given above are from an example from Darjiling. The precise range of the species is not determined.

Apparently the form described by Martin in the Monograph under the name *Anax bacchus* is really an example of *fumosus*. The true *Anax bacchus* Hagen is a synonym of *Anax parthenope* de Selys.[5]

LIST OF ORIENTAL SPECIES OF GENUS ANAX.

1. *Anax* (*Hemianax*) *ephippiger* Burmeister: India, Mediterranean countries.
2. *Anax parthenope* de Selys: India as far south as Mysore; Palaearctic.
3. *Anax immaculifrons* Rambus: Damascus, India to Hongkong.
4. *Anax guttatus* Rambur: Seychelle Islands to Papua and Samoa.
5. *Anax gibbosulus* Rambur: New Guinea, Moluccas.
6. *Anax fumosus* Hagen: North India, Japan, Celebes, Ternata.

Genus ANACIAESCHNA de Selys.[6]

Three species are included in this genus which has a wide range in the old-world tropics. Of these *Anaciaeschna jaspidea* Burmeister extends from India and Burma through Malaya and New Guinea to the Pacific. It has been recorded from Tahiti. The closely allied species, perhaps only a geographical race *Anaciaeschna megalopis* Martin, is from New Guinea, whilst the third species *Anaciaeschna triangulifera* MacLachlan, inhabits Madagascar and East Africa.

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[5] A short account of the Aeschnine dragonflies of the Indian Empire has recently appeared in the Records of the Indian Museum, (vol. 22, pt. 2, no. 11).

This was written by myself before I had undertaken the present paper. In that account I have described briefly three series of specimens belonging to the genus *Anax*, as "series A, B, C" of *Anax guttatus*. I now regard "series A" as examples of the true *guttatus* of Rambur; "series C" as belonging to *fumosus* Hagen; whilst the single specimens which constituted "series B" I take to be either a form of *fumosus*, or possibly a hybrid *guttatus* and *fumosus*.

[6] While this paper was in press Fraser (*Journ.* Bombay Nat. Hist. Soc., 1922, vol. 28, p. 699) has described an interesting and distinct new species from Southern Peninsular India under the name *A. donaldi*.

As its name implies the genus seems to link to *Anax* with *Aeschna*. Its species have traces of accessory lateral carinae on the abdominal segments 4-7, and the marked anterior curving of M_2 immediately below the pterostigma otherwise characteristic of *Anax*, whilst the male has the anal area of the hinder wing excavated, and the radial sector is forked.

Genus AMPHIAESCHNA de Selys.

A genus containing two species confined to the more equatorial parts of the oriental region; apparently allied to *Aeschna* though somewhat primitive. As regards venation the arculus is remarkable. The lower limb of this structure is not in line with the upper limb, and shows more clearly than it does in most Aeschnines, its origin as a reinforced cross nerve. A similar condition obtains in *Coryphaeschna*, and I was at one time inclined to suspect a possible relationship between that genus and *Amphiaeschna*. However, after studying a pair of *Coryphaeschna ingens* kindly loaned to me by Mr. Williamson, I have come to the conclusion that there is no close kinship between the two genera. *Amphiaeschna* resembles *Heliaeschna* fairly closely in venation, excepting as regards the arculus,[7] which in the latter genus is almost in a straight line. The dentigerous plates of the two genera are widely different, that of *Amphiaeschna* being rather *retrouse* armed with very small irregularly arranged spines. The species of *Amphiaeschna* are large handsomely colored insects; they inhabit thickly forested country, and probably breed in the small muddy pools that depend for their existence on a copious rainfall. I took two males of *grubaueri* in Perak about 305 meters (1,000 feet) above sea level flying about a forest pool of this kind, and with them a single male specimen of *Gomphidia perakensis* Laidlaw.

AMPHIAESCHNA GRUBAUERI Föster.

Represented in the collection before me by a single male, taken at Trang, lower Siam.

Of this species I have also seen two males from Perak caught by myself, now in the University Museum at Cambridge (England), and a single female from Mount Batu Lawi in Sarawak, Borneo.

I can find no specific differences between this species and *peramplo*, of Martin, which in my opinion must be regarded as a synonym of *grubaueri*.

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[7] Since this was written I have received a female of an undetermined species of *Heliaeschna* from the Malay Peninsula in which the arculus of the forewing resembles closely that of *Amphiaeschna*.

The hinder wing of the male is 62 mm. in length, the pterostigma is small, about 2.25 mm. long, and is well braced. The gray membranule is triangular in shape, and extends along one-third of the anal triangle. Both fore and hinder wings are tinged with rich brown at the base, the color extending as far as the first reinforced antenodal nerve in the costal space, and below this as far as the first median and submedian cross nerves. The anal area is uncolored. The upper lip, the ante and post clypeus are olive-green; the frons is dark brown, with a slightly metallic sheen near its apex. The vertex and small occiput are black.

The thorax is of a rich dark-brown color, with large yellow antehumeral bands, and two large yellow bands on either side.

The abdomen is 67 mm. long, and the upper anal appendages 6.5 mm. additional. Segments 2–6 are cylindrical, tapering a little from before backwards. The auricles are relatively small, armed with four or five large teeth. The postjugal part of 7 and the whole of 8, 9, 10 are broadened, and flattened dorsoventrally. The abdomen as a whole is dark brown, the apical segments progressively darker. The first segment is marked dorsally with lighter brown, as is the base of the second. Segments 2–6 have each an orange-yellow, apical ring, a trace of a similar ring showing on the seventh segment. The hindermost femora are long, reaching nearly the apex of the second segment. The female I have examined is teneral, the body and abdomen being crushed and broken. The length of the hinder wing is 63 mm.

In addition to the brown coloring of the wing bases, which is similar to that found in the males, all four wings have a transverse band of orange-brown extending across the wing from the nodus to the distal end of the pterostigma. Further, the base of the anal area is tinged with orange-brown.

The dentigerous plate is not unlike that of *Aeschna*, but appears to turn upward a little at its apex (possibly due to distortion). It carries a few small irregularly arranged spines. The anal appendages are short cylindrical processes.

A. grubaueri has been recorded from Malacca, Borneo, and Java.

AMPHIAESCHNA AMPLA (Rambur).

The other species of the genus, which is also the genotype, is *A. ampla* (Rambur). It is somewhat smaller than *grubaueri*, the length of the hinder wing being about 56 mm.

The males have brown markings at the bases of the wings, but are without yellow markings on the abdomen; whilst the upper anal appendages are without basal, ventral projection found in those of *grubaueri*.

The female has, in addition to the brown of the wing base, a light-brown transverse bar across the forewing between the nodus and pterostigma. The anal appendages are said to be very long, shaped like laurel leaves. The species occurs in Tonkin and Java; and will doubtlessly be found in intermediate territory.

Genus HELIAESCHNA de Selys.

Plate 1, fig. 3.

Six species of the genus are oriental and three Ethiopean. Förster has proposed to create a distinct genus for the Asiatic species with the name *Malayaeschna*. His reasons are that the latter have a longer triangle and wings more pointed relatively than the African species; and that whilst *Malayaeschna* has a four-toothed (or six-toothed) dentigerous plate the African *Heliaeschnas* have a two-pronged plate. It is worth remark that De Selys in his generic definition describes the dentigerous plate of *fuliginosa*, the genotype, in identical terms with that of *Gynacantha*.

The venational characters do not seem to be of much weight, and as the female of several of the species is unknown I do not here adopt Förster's genus, though I think it quite likely that his suggestion will prove ultimately to be well advised. The species of this genus appear to bear a fairly close resemblance to those of *Gynacantha*, and there is some justification for regarding them as representing an ancestral form of the latter genus. We may count the cross veins of the median space as a primitive character, and it is quite reasonable to see in the dentigerous plate a type of structure from which the highly specialized *Gynacantha* fork may have arisen. But the problem of *Periaeschna* must not be forgotten in this connection.

Another characteristic is the absence of the brace to the pterostigma in some of the species at any rate (*idae*, *fuliginosa*) whilst in *uninervulata* it is usually present.

Of the six species recorded from Asia, two *H. gladiostyla* Martin and *H. filostyla* Martin are from the Celebes. They are both unknown to me, but seem related to *H. idae* Brauer and to *H. crassa* Kruger from Borneo. Of these two latter the first is somewhat the larger, and has the hinder wing 54 mm. long and the abdomen 55 or 56 mm. in length, whilst *crassa* has measurements for the same structures, 50 mm. and 50 mm., respectively. The female of *idae* has a brown stripe occupying the subcostal space and running from the base of the forewing to the nodus, whilst a transverse band of lighter brown extends across the wing between the nodus and pterostigma. The hinder wing has only a dark basal mark in the costal and subcostal spaces extending to the level of the arculus.

These four species, of which I have seen *idae* only, seem to be related to each other in possessing rather pointed wings, and in the shape of the upper anal appendages of the male, these latter being in each case very long and slender (in *idae* they are 7.5 mm. long) and at least three times as long as the lower appendage. The Bornean species *simplicia* Karsch has the upper anal appendages straight, flattened dorsoventrally, and shaped like a hunting knife. The length of the hinder wing is about 45 mm.

Lastly, *uninervulata* Martin, recorded from Borneo, Engano (Sumatra), and now from Burma, is distinguished from the other Asiatic species by its more rounded wings, by the single cross nerve in the median space, and by the upper anal appendages of the male, which resemble those of the African species *weelei* Martin, being broad and bladelike with semicircular infolding of the inner margin and outcurved apex.

HELIAESCHNA UNINERVULATA Martin.

One male (in poor condition) Burma. R. A. Earnshaw, collector; collection E. B. Williamson.

The pterostigma is small, and in this specimen well braced. Martin's photograph (of a female) shows the pterostigma of the hinder wing unbraced.

The coloring of the specimen is entirely faded, and the abdomen in fragments.

Length of hinder wing 41 mm., of pterostigma 2.5 mm.

LIST OF ORIENTAL SPECIES OF THE GENUS HELIAESCHNA.

1. *H. gladiostyla* Martin: The Celebes.
2. *H. filostyla* Martin: The Celebes.
3. *H. idae* Brauer: Borneo.
4. *H. crassa* Kruger: Borneo.
5. *H. simplica* Karsch: Borneo.
6. *H. uninervulata* Martin: Borneo, Engano (Sumatra), Burma.

Genus TETRACANTHAGYNA de Selys.

Plate 1, fig. 4

The species comprised in this genus, probably the largest and bulkiest of all living dragonflies, seem to be a luxuriant development of the same stock as that from which *Heliaeschna* is derived. Not only is there a close similarity between the dentigerous plates of the two genera, but there is also a general resemblance in the venation, and both have at least in certain cases an unbraced pterostigma. The venation of *Tetracanthagyna* is certainly the denser, a feature almost certainly connected in this case with great size, and acquired secondarily. The males do not show narrowing of the abdomen at the second and third segments, this is perhaps a primitive character.

No species has been recorded from Burma, but the known range of the genus includes Tonkin, the Malay Peninsula, Borneo, and Sumatra, and it has been my good fortune to capture a single example of the genus, a female of *T. brunnea* MacLachlan, in Kelantan in the north of the peninsula, whilst I have seen a second female of the same species from the Malay State of Jalor which lies within the boundaries of lower Siam.

Five species have been named in the genus, but one of these names is probably a synonym.

The largest species, the most gigantesque of recent Odonata, is *T. plagiata* Waterhouse, recorded from Borneo, Sumatra, and the Malay Peninsula. The female may have a span of over 170 mm. The wings have a longitudinal brown costal band; and a transverse band of the same color is found, in the female only, between the nodus and pterostigma. *T. vittata* MacLachlan appears to differ only in that the wings of the female are without the transverse brown band. Doctor Ris has pointed out that it is possible that *plagiata* may have dimorphic females, *vittata* in that case becomes a synonym of *plagiata*. *T. brunnea* MacLachlan, from the Malay Peninsula and Borneo, is much smaller, with a span of rather less than 140 mm. The wings of the female are colored much as in *plagiata*, but the sides of the thorax are uniformly brown, whilst in *plagiata*, the thorax has two pale brown bands on either side. *T. degorsi* Martin, from Borneo, of about the same size as *brunnea* has a longitudinal band on the wings in both sexes, a very small yellow pterostigma, and the sides of the thorax rather greenish in hue. Lastly, *waterhousei* MacLachlan, from Borneo and Tonkin, has unbanded wings, a very small pterostigma with a black mark immediately below it, giving it rather the appearance of occupying a double row of cells; and the sides of the thorax each with two pale brown bands. The female is again of about the same size as that of *brunnea*.

The specimen of *brunnea* that I caught was fluttering about the trunk of a large forest tree. The flight did not impress me as being particularly powerful.

LIST OF ORIENTAL SPECIES OF THE GENUS TETRACANTHAGYNA

1. *T. brunnea* MacLachlan: Malay Peninsula and Borneo.
2. *T. plagiata* Waterhouse: Borneo, Sumatra, Malay Peninsula.
3. *T. degorsi* Martin: Borneo.
4. *T. waterhousei* MacLachlan: Borneo, Tonkin.

Genus AESCHNA Fabricius.

Unlike the other zoogeographical regions, with the sole exception of *Notogaea*, the oriental region is characterized by a dearth of species belonging to this genus.

Those which do occur, leaving out of account Japanese species which may in part at any rate have been derived from the Palearctic area, are found in the northeast ranges of the Himalaya and in Assam. Further it seems to me that of the three recorded species, one *petalura* Martin, is deserving of generic distinction. Not only has the female very remarkable anal appendages, but there are well-marked venational characters, notably the short triangles, and the course of the supplements almost parallel to Rs and M_4, respectively (according to Martin's figure), which differentiate the species strongly from other *Aeschnas*.

The two remaining species do not appear to be particularly closely related to other species of *Aeschna*, nor indeed to one another, though they show one peculiarity in common. In both species the apex of the dentigerous plate of the female carries a series of regularly arranged denticles radiating from the apical margin. In the case of all the other species of the genus that I have examined the dentides are arranged irregularly and on the ventral surface.

A. erythromelas MacLachlan is a large and handsome species found in northeast India and Tonkin. The hinder wing has a length of 55 mm. The thorax in both sexes is reddish-brown, with green antehumeral and lateral bands. The abdomen has segments 1–7 brown with small median and terminal markings of yellow on each. Segments 8–10 are black. The upper anal appendages of the male are spatulate. *A. ornithocephala* MacLachlan from Assan and the northeast Himalaya is smaller, the hinder wing having a length of 48 mm. The venation is open, and the triangle shorter than is usual in the genus; the pterostigma is small, 3 mm. long. The anal appendages of the male somewhat resembles those of the Japanese *A. melanictera* Selys and as in that species the male has a prominent spur on the dorsum of the tenth abdominal segment. Doctor Annandale has observed females of this species ovipositing in the muddy banks of small pools on the Himalayas, some feet away from the water.

LIST OF ORIENTAL SPECIES OF GENUS AESCHNA.

1. *A. petalura* Martin: Northeast ranges of the Himalaya and Assam?
2. *A. erythromelas* MacLachlan: Northeast India, Tonkin.
3. *A. ornithocephala* MacLachlan: Assam and northeast Himalaya.

Genus GYNACANTHA Rambur.[8]

A good account of the oriental species of this rather difficult genus was given by Kruger in 1898.

He listed the following species: *G. furcata* Rambur, *subinterrupta* Rambur, *rosenbergi* Brauer, *hyalina* de Selys, *basiguttata* de Selys, *nigripes* de Selys, *bayadera* de Selys, *limbalis* Karsch, *musa* Karsch, *dohrni* Kruger, *maclachlani* Kruger, 11 species in all. Of these *rosenbergi* almost certainly does not occur within the limits of the region, and *nigripes* is a race or color variety of MacLachlan's species *khasiaca*.

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[8] Since these notes were sent to press Fraser has described three new species of this genus; one from Bengal, *G. o'doneli* (Journ. Bombay Nat. Hist. Soc., 1922, vol. 28, p. 700) is allied to *millardi* but is smaller; two others *bainbriggei* and *hanumana* (Mem. Dept. Agric. India, Ent. Ser., vol. 7, no. 7, p. 75 and 76 respectively) come from the Himalayas.

Martin added one species in his Monograph, viz, *saltatrix*.

Ris described a new species *demeter* from Borneo (1911).

The same author made an important faunistic contribution to our knowledge of the genus in 1913 in his paper on "Nova Guinea," in which he characterizes two new species from north Celebes, *nausicaa*, and *penelope*, and gives useful figures of the anal appendages of the males of these and of certain other species. In addition *japonica* Bartenef must be regarded as belonging to our fauna; Ris has recorded it from Formosa (1916), and remarks that it is the species which was formerly recorded from Japan as *rosenbergi*. Lastly Fraser has recently described a new species *millardi* from India, but I have not yet seen his account. So that our list is a fairly long one, including some 16 names.

I have been able to examine specimens of the undermentioned forms: *hyalina*, *basiguttata*, *khasiaca*, *bayadera*, *dohrni*, *saltatrix*, and *millardi*.

Summarizing the distribution of the species of the genus we may say that a considerable number of species are apparently restricted to the more equatorial parts of the region especially to the great Malay Islands, a few are restricted to the northern half, and a certain number range over at least a large part of the whole area. Southern India and Ceylon are very imperfectly known. Kirby[9] reports *subinterrupta* and *furcata* for Ceylon but the latter must, I think, be a mistaken determination. The genus is in some respects the most specialized of all the Aeschnines; it is so far as I know the only Odonate genus that is definitely crepuscular in its habits. Physiologically it seems to differ from other dragonflies in that dead specimens are particularly liable to "grease" and lose their coloring to a greater extent than any others. The anal appendages of the females are rarely preserved intact in collected specimens. Major Fraser tells me that they often have the appearance of having been nibbled off, but most probably they are damaged either during copulation or in oviposition. They do not so far as I know resemble except in a general way those of the male, and are usually stalked and lanceolate.

The coloring when well preserved is soft and beautiful, of such a nature as to conceal the insect very effectually when at rest on foliage. *Gynacantha* is the only genus of Aeshnines that is definitely holotropical, not extending to more temperate climates (except for *G. japonica*).

GYNACANTHA MILLARDI **Fraser.**[10]

The most distinct, and also the latest species to be described is ***millardi***. It differs from all its Asiatic congeners, and resembles certain South American species (e. g., *nervosa* Rambur) in having the abdomen almost cylindrical throughout. The nerves of the wings are of a medium brown color, the pterostigna is of a creamy yellow, and there is no definite T-mark on the frons. The thorax is uniformly grass green with a beautiful enamel-like surface; the legs are brownish-yellow throughout, with dark brown spines. The length of the abdomen is 42 mm. with an additional 5 mm. for the anal appendages. The hinder wing is also 42 mm. long.

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[9] Kirby, Journ. Linn. Soc. London, vol. 24, 1893, p. 558.

[10] *Gynacantha millardi* Fraser, Journ. Bombay Nat. Hist. Soc., vol. 27, p. 147.

I have a pair from Poona given me by Major Fraser, and I have also seen an immature male from Chota Nagpur, in the collection of the Indian Museum. So that the recorded range of the species is in northern Peninsular India.

GYNACANTHA BASIGUTTATA de Selys.

G. basiguttata is a large species, the abdomen and hinder wing of the male having a length of about 50 mm. each, whilst the anal appendages of the same sex are 6.5 mm. long. The abdomen is strongly compressed at the middle of the third abdominal segment and the auricles are large. A T-shaped mark is present on the frons. Both fore and hinder wings are tinged with deep brown in the costal and subcostal spaces, from the wing base to the level of the first antenodal nerve; the legs are black. The readiest guide to the determination of the species is found in the shape of the anal appendages of the male. These are markedly spatulate, the apical third being flattened and dilated so that each is shaped not unlike the business end of a wooden golf club, save that the "head" is not inclined to the "shaft" at so great an angle as in the case in the club.

This species has a wide range, from Burma and the Indo-Chinese Peninsula, through the Malay Peninsula and islands, to the Philippines and Celebes reaching apparently the Loo-Choo Islands to the north. Ris had pointed out (1911) that Martin's Figure 197 on page 193 in his Monograph is not a figure of the anal appendages of the male of this species, but more probably of those of *dohrni*. Another species with spatulate anal appendages in the male is *musa*. In this case the apices of the appendages are obliquely truncate, and the lower appendage is more than one-half as long as the upper pair, whilst in *basiguttata* the lower is only one-third as long. The legs are brown. The wings are without basal coloring; in size the species is about equal to *basiguttata*.

G. musa is restricted apparently to Java; reported doubtfully from New Guinea.

Three males, one from Khow Sai Dow Mountain about 305 meters, (1,000 feet), Trong, lower Siam, the two other specimens from Trong, lower Siam; collector Dr. W. L. Abbott, collection U.S.N.M.

This species is readily distinguished, so far as the male is concerned, from its eastern congeners by the shape of the anal appendages.

Length of abdomen 49 mm., of hinder wing 48 mm., of anal appendages 6.5 mm., and of pterostigma 4 mm.

GYNACANTHA DOHRNI Kruger.

Plate 1, fig. 5.

The next three species, all recorded from Borneo, may be regarded as forming a natural group, characterized by the great widening of the base of the abdomen, which when viewed from above is approximately circular in outline whilst the narrowing of the third segment is extreme; by the great size of the auricles, by the absence of a T-shaped mark on the frons, and by the brown color of the legs. The upper anal appendages of the males are very long and slender, not less than four times as long as the lower appendage. Of the three, *dohrni* from Sumatra, Java, and Borneo has the base of the hinder wing tinged with brown in the subcostal and cubital spaces as far as the level of the first antenodal nerve, whilst the innermost well of the anal triangle is also tinged with the same color.

The female has similar markings at the base of the hinder wing, but in this sex the whole wing is richly and evenly suffused with golden-brown. The anal appendages of the male have a small internal subbasal projection, and the pointed apices are directed almost straight backwards. The appendages, upper pair, have a length of 7.2 mm., whilst the wings are about 43 mm. in the male, and 47 mm. in the female.

GYNACANTHA DEMETER Ris.

G. demeter from Borneo is very similar. The male has the wing base hyaline or very lightly suffused with yellow. The upper anal appendages of the male are similar to those of *dohrni*, but shorter, only 6 mm. in length, with the more sharply acuminate apices directed rather laterally. The female in this species also has the wings strongly suffused with brown, which in some specimens deepens in tone be tween the nodus and pterostigma. In size this species approximates closely to the last.

GYNACANTHA MACLACHLANI Kruger.

G. maclachlani, the third of the group, has the upper anal appendages of the male without a subbasal projection, about 6.5 mm. in length, a little more dilated apically than is the case in the two previous species, which it resembles closely in size. Kruger in his original account gives the length of the abdomen at 44–46.5 mm. and of the hinder wing 45 mm. The pterostigma seems to be smaller than in either *dohrni* or *demeter*, 3 mm. as against 3.5 mm. (Martin gives New Guinea as a habitat for this species, but as his measurements are very different from those given by Kruger I can not feel sure that he is dealing with Kruger's species. Ris rejects his record as unlikely.) Another species *bayadera* resembles this small group in being without a T-shaped mark on the frons, and in having brown legs. But it differs markedly in having the abdominal base much less distended, the auricles relatively much smaller, and the third abdominal segment much less narrowly constricted. The lower anal appendage is nearly half the length of the upper pair which are about 5 mm. long. The species is a small one with the hinder wing of the male about 37 mm. long; the wings are relatively broader than are those of the three last species. It has apparently a much wider range than those species and is recorded from the Himalayas, India, Burma, the Malay Peninsula, and islands as far as the Celebes.

GYNACANTHA HYALINA de Selys and SUBINTERRUPTA Rambur.

The two species *hyalina* and *subinterrupta* are evidently very closely allied; both have a well-defined T-shaped mark on the frons. The base of the abdomen is more inflated, and the auricles relatively larger than in *bayadera*, but not to the same extent as in *basiguttata* and still less than in *dohrni* and in its immediate allies. The upper anal appendages of the males are about 6 mm. long, shaped like a single-edged straight sword, more than twice as long as the lower appendages in the case of *hyalina*, three times as long or a trifle more in *subinterrupta*. Both are species of moderate size, the hinder wing having a length of about 43 mm. and the abdomen of 46 mm. Ris gives the following as among the chief characters separating *hyalina* from *subinterrupta*. Pterostigma distinctly and invariably shorter (3 mm. as against 3.5 mm). The T-shaped mark of the frons broader both in the longitudinal and in the transverse part. The coloring is also different, *hyalina* according to Ris is brilliant blue and green in the adult, *subinterrupta* with a nuance of brown only; *hyalina* has the knees dark brown, *subinterrupta* has the legs entirely light brown.

Both species have a wide distribution. Ris gives for *hyalina* Formosa and the Philippines, for *subinterrupta* Celebes, Java, and Lombok. The United States National Museum has two specimens of *hyalina* from lower Siam, and I have examined specimens (females only) in the Indian Museum labeled *hyalina* by de Selys, himself, from Assam.

GYNACANTHA HYALINA de Selys.

Two males, Trong, Lower Siam, Dr. W. L. Abbott, collector; collection of the U.S.N.M.

One specimen immature, both faded to a dark dull brown. The anal appendages resemble almost exactly those figured for the species by Ris, and are exactly like those of an Indian specimen before me.

Length of abdomen 43 mm., of hinder wing 43 mm., of upper anal appendages 6.5 mm., of pterostigma 3 mm.

GYNACANTHA JAPONICA Bartenef.

The most northerly ranging species of this genus, *japonica*, is apparently closely allied to the two preceding species and has been distinguished from *hyalina* only since 1909.[11] The anal appendages of the male are about 6.5 mm. long; narrow with parallel sides, with very blunt apices, and with a distinct internal subdorsal projection. The lower appendage is about one-fourth the length of the upper pair.

In size *japonica* stands very near *hyalina*, the male having the hinder wing 42 mm. long and the abdomen 45 mm. The same measurements in the female are 47 mm. and 50 mm., respectively.

GYNACANTHA SALTATRIX Martin.

The small species *saltatrix*, of which I have seen a single male from the Mangaldai district of Assam is related to the group *subinterrupta*, *hyalina*, *japonica* by the shape of the anal appendages of the male, by the possession of a well marked T-shaped mark on the frons and by the degree of inflation of the base of the abdomen and size of the auricles. The type specimen from Tonkin has the hinder wing 35 mm. in length and the abdomen 42 mm. The example seen by me has the following measurements, hinder wing 36.5 mm., abdomen 42 mm. Upper anal appendages 5 mm., pterostigma 3.5 mm., breadth of hinder wing at nodus 11 mm. The lower anal appendage is nearly one-half the length of the upper pair. The wings are without basal markings, whilst in the other members of the group the subcostal and cubital spaces have a brown tinge barely reaching the level of the first antenodal nerve. In my specimen the color is much faded; the thorax appears to be of an almost uniform dull green-brown; the legs are uniformly brown. The dorsal surface of the abdomen is black, with a slightly metallic luster, the first segment and the basal half of the second are blue laterally, the auricles are blue edged with black. Segments 2–10 have each a pair of apical lateral yellow spots, very minute from 2–5, increasing therefrom to 9, on which segment they extend for its whole length, widening distally. The sides of the distal half of the second segment, and the ventral surface of the whole abdomen is yellow. The upper anal appendages are brownish black; the lower appendage is pale yellow, its apex tipped with black.

GYNACANTHA KHASIACA MacLachlan.

The other northern species *khasiaca* from Assam is a larger and more robust insect. Martin figures a race *nigripes* (de Selys MS) to which race Kruger also refers. The locality given for this race

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[11] Bartenef, Samml. Zool. Mus. Univ. Tomsk. 11–13, p. 7 (Russian), p. 14 (English), 1909 pl. 2, figs. 7 9, 10

Tibet is a mistake, de Selys in several cases referred material from the East Himalayas to Tibet where Assam would have been correct. Moreover I doubt if the race *nigripes* can be regarded as valid. Martin gives as one of the points separating it from the typical *khasiaca* that the wings of *nigripes* are without a tinge of saffron at the base; whilst his colored figure of *nigripes* shows the saffron tinge very distinctly. I have been able to compare two males, one in excellent condition from Kobo in the north of Assam, the other much faded from the Mangaldai district also in Assam. The former certainly comes from a district which Selys referred to as Tibet. It is however a brightly colored insect, not at all like Martin's figure which is copied from a very discolored example.

In the Kobo specimen the lower lip is dull yellow, the upper lip front of the head, and eyes, olive-green. There is a well-developed T-shaped mark, the vertical part being very broad.

The thorax is of a bright olive-green, the mid-dorsal carina, the humeral sutures, and a line in the position of the first lateral suture sharply defined with black. The inter-alar space has bright blue markings. The femora are dark brown, their anterior surfaces almost black. The tibiae and tarsal joints are brown. The abdomen is black, the base of the first segment dark brown. The second segment has a large anterior and posterior blue spot on either side, the auricle is blue, its margin finely outlined with black. The mid-dorsal longitudinal line of the segment is blue, and on either side of this there is a median linear blue mark and a posterior blue spot, in addition to the lateral blue markings. The third segment has a basal lateral blue mark. Otherwise the abdomen is wholly black save that the sixth segment has a small pair of transverse linear marks before its middle, and that the apex of each segment ventrally is brown. The anal appendages are exactly as figured by Martin; black in color, the lower appendage about two-thirds the length of the upper pair. The base of the wings are just perceptibly tinged with saffron for a length of about 2 mm.

The hinderwing of this specimen is 43 mm. long and 12 mm. in breadth. The abdomen (somewhat flexed) is about 47 mm. in length and the upper anal appendages 6 mm.

The Mangaldai specimen which is much faded resembles closely in coloring Martin's figure.

I think we may conclude that the race *nigripes* is founded on a specimen in which the coloring is badly retained, and that the race is in all probability not valid.

GYNACANTHA FURCATA Rambur.

The next species *furcata* was founded on a female specimen which was without a T-shaped mark on the frons. Ris has expressed the opinion that this specimen probably belonged to one or other of the species subsequently described under the names *dohrni*, *demeter*, or *maclachlani*, all of which like the type specimen of *furcata* occur in Borneo.

The specimen figured by Martin (1910, fig. 202, p. 198) as the male of *furcata*, from Tonkin, can hardly in Doctor Ris's opinion (1913) belong to that species as it has a well marked T on the frons. For the present therefore it must be regarded as an unnamed species. The anal appendages are similar in shape to those of certain African species.

GYNACANTHA LIMBALIS Karsch.

The very large species *limbalis* known only I believe from a single male from Java is not likely to be confused with any of the oriental species at present known, on account of its large size, the hinder wing measuring according to Martin 61 mm.; and because the wings have a costal band of color extending nearly the whole length of the wings. There is a T-shaped mark on the frons, and the abdomen is much narrowed at the third segment.

GYNACANTHA NAUSICAA Ris and PENELOPE Ris.

The remaining species are both from the Celebes and are both described and figured by Ris in Nova Guinea. The first *nausicaa* has a T-shaped mark on the frons. The wings are relatively narrow with long triangles. The upper anal appendages of the male gradually and regularly widened distally, ending in a backwardly directed rather blunt apical point. The lower appendage is a little less than half the length of the upper pair. The hinder wing is 47 mm. long and 13 mm. across. There is only a single row of cells in the field lying between M_1 and M_2. The upper anal appendages measure 6 mm.

The second species *penelope* has the longitudinal part of the T-mark feebly developed or absent. The wings are relatively broad, with two rows of cells in the field M_1-M_2. The upper anal appendages of the male have their outer margin regularly convex, not much widened distally, and end in a point which is directed rather laterally. The hinder wing is 45 mm. long and 13 mm. wide at the nodus. The upper anal appendages are 6.5 mm. long, the inferior appendage less than one-half as long.

G. nausicaa has the thorax green, with green and blue markings on the abdomen. *G. penelope* has olive-green markings on the thorax and abdomen. Both have light reddish-brown legs.

GYNACANTHA BAYADERA de Selys.

One male, Khow Sai Dow Mountain, 305 meters (1,000 feet), Trong, Lower Siam, January-February, 1899, Dr. W. L. Abbott, collector; collection of the United States National Museum.

The species has an extensive range, apparently from Sikkim to Formosa, and as far to the southeast as the Celebes. The single specimen has the anal appendages exactly similar to those figured for the species by Ris from a specimen from north Celebes; the coloring is much faded.

Length of abdomen 50 mm., of hinder wing 38 mm., of anal appendages 4.5 mm., and of pterostigma 3.25 mm.

LIST OF ORIENTAL SPECIES OF GENUS GYNACANTHA.

1.	*G. furcata* Rambur	Borneo (female type) (furcata?).
2.	*G. subinterrupta* Rambur	Celebes, Java and Lombok, Ceylon.
3.	*G. hyalina* de Selys	Formsa and the Philippines, lower Siam (2 males), Assam (females).
4.	*G. basiguttata* de Selys	Burma and Indo-Chinese Peninsula. Through Malay Peninsula and Islands to Philippines and Celebes, reaching apparently the Loo Choo (Rhu Kyu) Isands to the north.
5.	*G. limbalis* Karsch	Java.
6.	*G. musa* Karsch	Java, New Guinea?
7.	*G. dohrni* Kruger	Sumatra, Java, Borneo.
8.	*G. machlachlani* Kruger	Borneo.
9.	*G. khasiaca* MacLachlan	Assam.
10.	*G. saltatrix* Martin	Mangaldai district of Assam (1 male). Tonkin (male type).
11.	*G. demeter* Ris	Borneo.
12.	*G. nausicaa* Ris	North Celebes.
13.	*G. penelope* Ris	North Celebes.
14.	*G. japonica* Bartenef	Formosa, Japan.
15.	*G. millardi* Fraser	Northern Peninsular India.
16.	*G. bayadera* de Selys	Sikkim to Formosa, and southeast to the Celebes.

SUMMARY OF ORIENTAL SPECIES OF AESCHNINAE.

The number of species (or well-marked subspecies) allowed in the above account for each genus is tabulated below:[12]

Jagoria 6.
Linaeschna 1.
"*Austroaeschna*" 2.
"*Cephalaeschna*" 5.[13]
Periaeschna 1.
Heliaeschna 6.
Amphiaeschna 2.
Aeschna 3.
Tetracanthagyna 4.
Anaciaeschna 2.
Anax 6.
Gynacantha 19.

Making a total of 57 species in all.

Aeschnophlebia de Selys from Japan is regarded by Ris as coming near *Brachytron*. As it is probably a Palaearctic form it is omitted in this list.

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[12] In this summary the species recently described by Fraser have been included. These species are not treated in the text and are only mentioned in footnotes.

[13] One of these has been removed to a new genus, see footnote 4.

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I have added to the list also a reference to a paper by Kruger on the Aeschnines of Sumatra and neighboring countries, and the important papers by Ris and Tillyard on the species of the same subfamily found in New Guinea and Australia, respectively. In both these accounts there is material of interest for the student of the oriental Fauna.

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EXPLANATION OF PLATE.

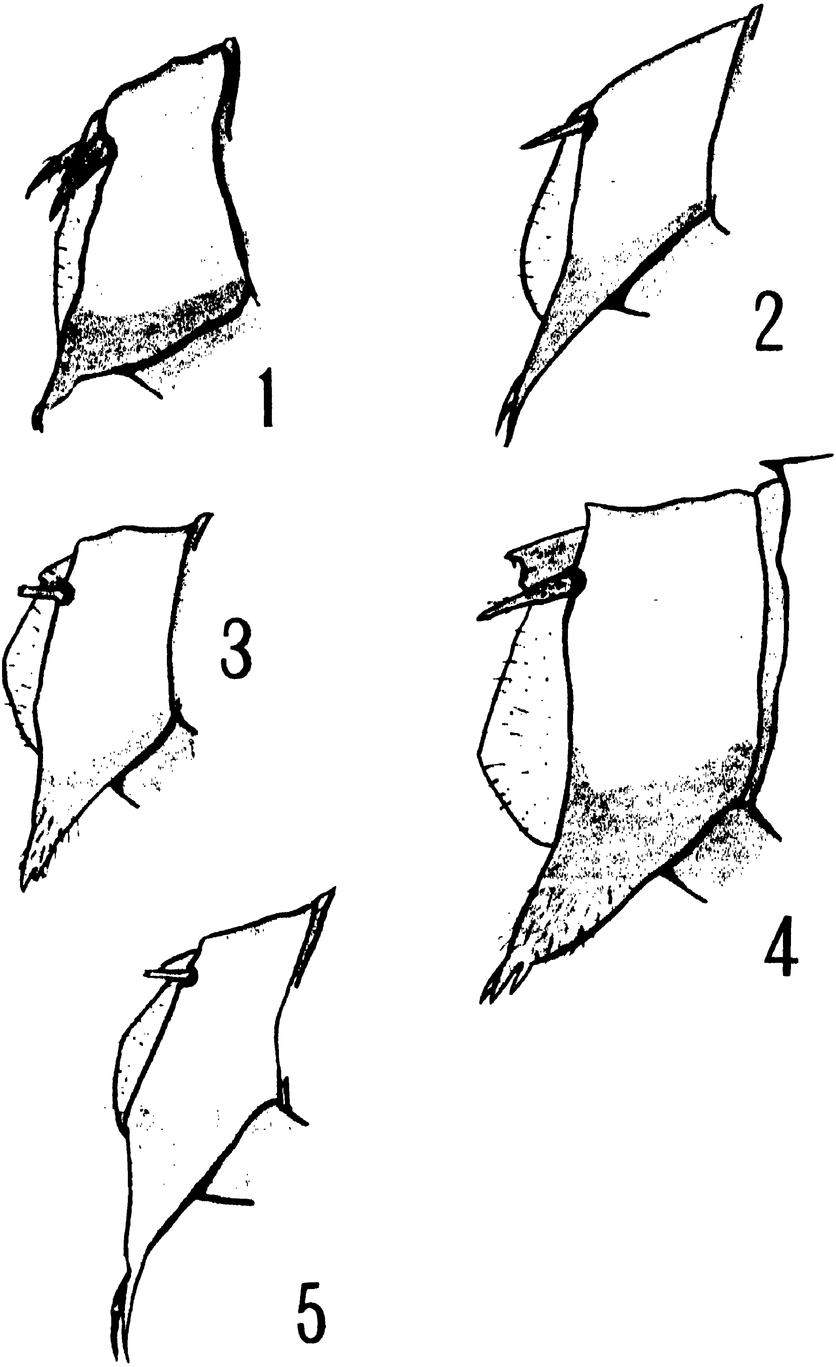
FIG. 1. Lateral view of apex of abdomen of "*Cephalaeschna*," species, female, allied to *sikkima* Karch. Drawn from a specimen from Assam in the collection of the Indian Museum.

2. Lateral view of apex of abdomen of *Periaeschna magdalena*, female. From a specimen from the Garo Hills, Assam, in the collection of the Indian Museum.

3. Lateral view of apex of abdomen of *Heliaeschna idae*, female. From a specimen from Borneo, in the collection of the author.

4. Lateral view of apex of abdomen of *Tetracanthagyna brunnea*, female. From a specimen from Jalor, Siamese Malay States, in the collection of the author.

5. Lateral view of apex of abdomen of *Gynacantha dohrni*, female. From a specimen from Borneo, in the collection of the author.



AESCHNINE DRAGONFLIES FROM BURMA AND LOWER SIAM

FOR EXPLANATION OF PLATE SEE PAGE 29

STEIROXYS HENDERSONI, A NEW KATYDID FROM UTAH.

By A. N. Caudell,

Custodian of Orthoptera, United States National Museum.

Description, male and female.—General size and appearance much as in *S. pallidipalpus.* Head and pronotum scarcely exhibiting differentiating characters, the lateral carina of the latter varying from almost straight to slightly incurved at the anterior fourth and the disk always noticeably, though very moderately, broader posteriorly. Organs of flight essentially as in previously described forms. Legs long and not noticeably differing from those of other species. Cerci of the male very different from those of any described species of the genus; the main body is subcylindrical, gently flattened basally and slightly more so apically, especially on the inner side; a sharp, slender, chitinized spine, straight and directed caudad and inwardly, arises on the outer apical margin of the cercus, situated on a terminal hump; the dorsal half of the inner apical terminus of the cercus is prolonged into a slender strongly incurved and apically gently upcurved process, gradually narrowing to an acute chitinized point, the whole almost as long as the main body of the cercus; the general appearance, from a dorso-lateral view, is shown by the present sketch and illustrates it better than a description can do. Ovipositor gently curved upwards, scarcely differing from those of other described species of this genus.

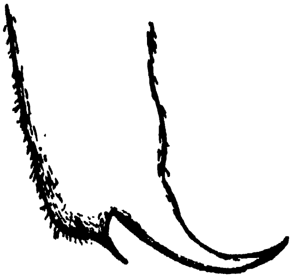


FIG. 1.—CERCUS OF MALE, DORSO-LATERAL VIEW.

Color varying from greenish to brown, mostly yellowish-brown in dried material; the lateral lobes of the pronotum are unicolorous or somewhat darkened, and the caudal margin is often more or less strongly marked with yellowish-white.

Measurements.—Length, pronotum, male, 6.9 mm., female, 7 mm.; posterior femora, male, 21 mm., female, 22 mm.; ovipositor, 18 mm.; width, pronotal disk posteriorly, male, 4 mm., female, 4 mm.; posterior femora at widest point, male, 3.75 mm., females, 4 mm.

Type locality.—Dry Lake, Utah.

Described from 6 males and 12 females, all adults; W. W. Henderson, collector; October 3, 1921. Type, male, allotype, female, paratypes A to E, males, and F. to P, females.

Type, *allotype*, and *paratypes* A to C and F to K in United States National Museum.—Catal. No. 25492, U. S. N. M.

Paratypes D to E and L to P returned to Prof. W. W. Henderson.

Aside from coloration, and that varying but little in dried material, there is not much variation noticeable in the 18 examples of the present species examined. The size varies very slightly, the posterior femora ranging from 20 to 21 mm. in length in the males and 20 to 22 mm. in the females, and the ovipositor from 15 to 18 mm.; but the cerci of the males varies scarcely at all.

The coloration of living specimens is evidently rather different from that of cabinet material, as shown by the following note extracted from a recent letter from the collector, in whose honor this species is named.

> This species is numerous in September in one of our high mountain valleys. I do not have the specific elevation, but estimate it to be about 5,500 feet. The valley is very small, hedged in by high mountains and contains only a few hundred acres. I have not observed this species anywhere else in the State. Females were especially numerous in an adjoining alfalfa field. Males were very much less numerous, or at least more difficult to find. I took considerable time in finding the few males which I have in the collection. I might add in relation to the Decticinaens that they have lost color considerably. Some of them when captured are a rich dark green in color and others a rich brown. A few of them have a broad light band extending the full length of the dorsal surface. I do not know the significance of this band.

The species described above is so evidently distinct from any hitherto known that it is deemed well to characterize it in spite of the unsatisfactory systematic condition of the genus into which it falls. This seems the more desirable from the fact that some light is shed on the supposed variability of cercal structure as discussed by the writer some years ago,[1] From the several specimens of both sexes on which the present species is based and the above-quoted note by the collector, it is seen that the coloration varies, as indicated by the writer in his previous notes; but the variation of the cerci of the males, to judge from the half dozen adult specimens of that sex examined, is decidedly less than formerly supposed. Thus the variously formed cerci noted in the former article may be indicative of specific distinctness, and thus this genus may eventually be found to include at least half a dozen distinct species, many of which, including the one here described, will very likely prove rather restricted in their distribution.

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[1] Proc. U. S. Nat. Mus., vol. 32, pp. 405–409, 1907.